INTERFACE AGE™

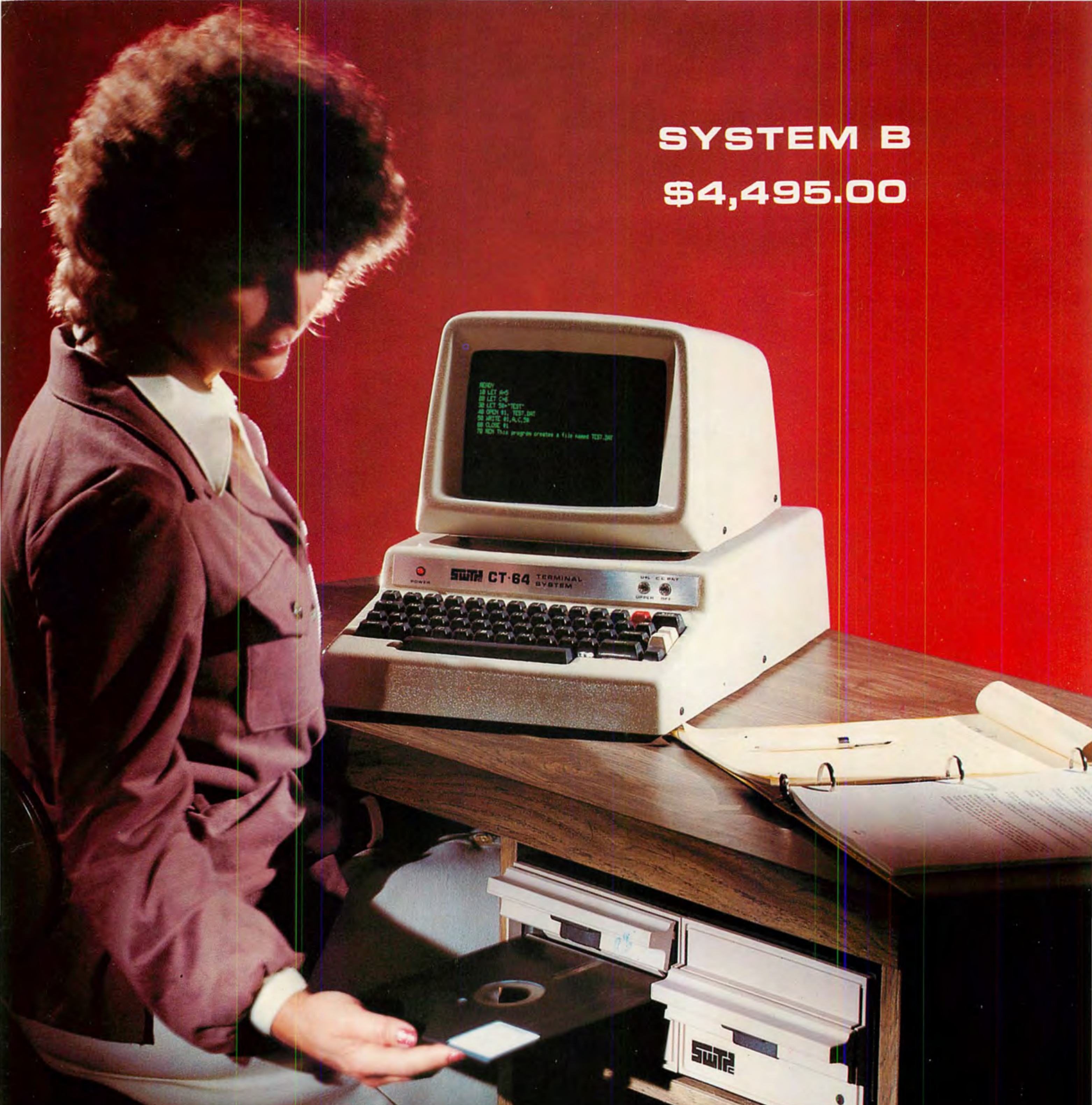
COMPUTING FOR HOME AND BUSINESS APPLICATIONS VOLUME 3, ISSUE 9 SEPTEMBER 1978 $2.00
CANADA/MEXICO $2.50 INTERNATIONAL $3.50

THE EDUCATIONAL ISSUE

Bob Albrecht Talks About Kids, Computers and Learning

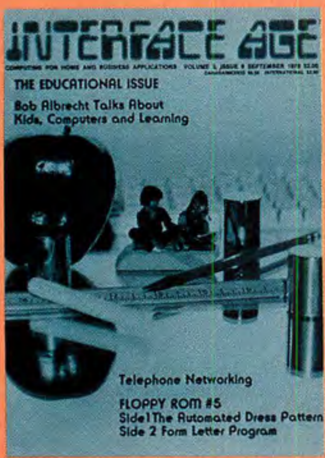
Telephone Networking

FLOPPY ROM #5
Side 1 The Automated Dress Pattern
Side 2 Form Letter Program


SYSTEM B
$4,495.00
CT-64 TERMINAL SYSTEM

VOL. 3, ISSUE 9
SINCE DECEMBER 1975

SEPTEMBER 1978



THIS MONTH'S COVER

The cylinders are interspersed, the pencil large; the keyboard looms in the background while two school children are perched upon a giant eraser. Their interest is centered on a book, the symbol of education. But they are surrounded by other tools of education, particularly those which represent the computer. This is an artist's perception of computers in education and this is the theme of September's issue of INTERFACE AGE.

The cover picture was conceived and produced by Fino Ortiz, Art Director; photography by Margaret Fenstermaker and Shelley Wright. Special thanks have been extended to the two children who sit on the eraser. Also, special thanks go to Datanetics for the background keys.

INTERFACE AGE™

COMPUTING FOR HOME AND BUSINESS APPLICATIONS

VOL. 3, ISSUE 9
SINCE DECEMBER 1975

SEPTEMBER 1978

GENERAL FEATURES

BUSINESS FEATURES

HARDWARE FEATURES

SOFTWARE FEATURES

ATTENTION SUBSCRIBERS:
In the event of a Postal Service strike, check with your nearest Radio Shack about picking up your October issue of INTERFACE AGE.

INTERFACE AGE Magazine, published monthly by McPheters, Wolfe & Jones, 16704 Marquardt Ave., Cerritos, CA 90701. Subscription rates: U.S. $14.00, Canada/Mexico $16.00, all other countries $24.00. Make checks payable in U.S. funds drawn on a U.S. bank. Opinions expressed in by-lined articles do not necessarily reflect the opinion of this magazine or the publisher. Mention of products by trade name in editorial material or advertisements contained herein in no way constitutes endorsement of the product or products by this magazine or the publisher.

INTERFACE AGE Magazine is catalogued in the Library of Congress, Classification No. QA75.5.155. Membership in Audit Bureau of Circulations applied for.
POSTMASTER: Please send change of address form 3579 and undelivered copies to **INTERFACE AGE** Magazine, 16704 Marquardt Ave., Cerritos, CA 90701. Second-class postage paid at Artesia, California 90701 and at additional mailing offices.

INTERFACE AGE™

16704 Marquardt Avenue, Cerritos, CA 90701
(213) 926-9544

PUBLISHER & EDITOR-IN-CHIEF **ROBERT S. JONES**
EXECUTIVE PUBLISHER **NANCY A. JONES**
ASSISTANT-TO-THE-PUBLISHER **KATHY ROBERTSON**
GENERAL MANAGER **EVA YAKA**
MARKETING MANAGER **MEL MURCHISON**
MARKETING ASSISTANT **DENISE JACKSON**

ADMINISTRATION

PUBLICATION DIRECTOR **MIKE ANTICH**
CIRCULATION MANAGER **DONNA YOSHIOKA**
SUBSCRIPTION CIRCULATION **JO ANN FERGUSON**
DOMESTIC RETAIL CIRCULATION **ZACH BOVINETTE**
(213) 795-7002
ACCOUNTING ASSISTANT **SAYOKO TANISAKI**

EDITORIAL

SENIOR EDITOR **CARL WARREN**
ASSISTANT EDITOR **SANDRA EVANS**
NORTHWESTERN REGIONAL EDITOR **ADAM OSBORNE, PhD**
NORTHEASTERN REGIONAL EDITOR **ROGER C. GARRETT**
SOUTHEASTERN REGIONAL EDITOR **BILL TURNER**
HARDWARE EDITOR **ROGER EDELSON**
CONTRIBUTING EDITOR **ALAN MILLER**

Editorial Correspondence
Direct all correspondence to the appropriate editor at: INTERFACE AGE Magazine, P.O. Box 1234, Cerritos, CA 90701.

PRODUCTION

PRODUCTION MANAGER **MARGARET FENSTERMAKER**
ASSISTANT PRODUCTION MANAGER **SHELLEY WRIGHT**
ART DIRECTOR **FINO ORTIZ**
TYPOGRAPHER **MELODY A. MARTENS**

ADVERTISING

NEW ENGLAND REGION **DICK GREEN**
7 Lincoln St., Wakefield, MA 01880 (617) 246-1986

EASTERN REGION **TONY CARLSON**
20 Community Pl., Morristown, NJ 07960 (201) 267-3032

MIDWEST REGION **AL GRAVENHORST & STEVE SKINNER**
5901 N. Cicero Ave., Chicago, IL 60046 (312) 545-8621

WESTERN REGION **BRUCE BERKEY & ZACH BOVINETTE**
DENIS SEGER
61 S. Lake Ave., Pasadena, CA 91106 (213) 795-7002

COMPUTER RETAIL STORES NATIONWIDE
CALL (213) 795-7002 (COLLECT)

FOREIGN CIRCULATION

JAPAN CIRCULATION **KAZUHIKO NISHI**
ASCII Publishing - 305 HI TORIO, 5-6-4 Minami Aoyama, Minato-ku, Tokyo 107 Japan
Telephone: (03) 407-4910

UNITED KINGDOM CIRCULATION **VINCENT COEN**
L.P. Enterprise, 313 Kingston Road, Ilford, Essex, England IGIIPJ.
Telephone: 01-553-1001

WESTERN CANADA CIRCULATION **BRIAN I.J. WIEBE**
Kitronic, 25236 26th Avenue RR5, Aldergrove, B.C. VOX 1A0
Telephone: (604) 856-2301

EASTERN CANADA CIRCULATION **LIZ JANEK**
RS-232, Ltd., 186 Queen Street West, Toronto, Ontario M5V 1Z1
Telephone: (426) 598-0288

AUSTRALIA CIRCULATION **R. J. HOESS**
Electronic Concepts Pty. Ltd., 52-58 Clarence Street, Sydney NSW 2000
Telephone: 29-3753

INDONESIA, SINGAPORE, MALAYSIA CIRCULATION **LEE MILES**
The Computer Centre, Pte. Ltd., 5366, Woh Hup Complex
Beach Rd. Singapore 7
Telephone: 293-2630

MEMBER OF THE WESTERN PUBLICATIONS ASSOCIATION wpa

AMERICAN SOCIETY OF BUSINESS PRESS EDITORS ASBPE

EDITOR'S NOTEBOOK

LETTERS

Everyday we receive a number of letters from readers requesting information about a product or how to contact someone. We make every effort to answer these as quickly as possible, usually within five working days. However, we sometimes run into the problem of where to send the answer. This is because there is no return address on the letter itself — only on the envelope.

Therefore, if you write to us and need the information, please include your address on the letter.

HAPPENING

Each month I always plan time to check with companies to see what they are planning and to keep up to date with some of the interesting industry happenings. This month I had the chance to talk to Jim Schreier who puts out the Schreier Index to Published Microcomputer Software. Jim has just finished his latest edition which has been available since the first two weeks of August. He is very excited about this edition which he says is over 150 pages.

This year he has carried his index one step further and is making it available on disk. It can be ordered with any definition that you want by specifying the desired category. The disk is for the Southwest MINIFLEX or FLEX system, and uses ASCII files. For those of you who are interested in either the book or disk version, contact: Jim Schreier, The Schreier Index to Published Microcomputer Software, 4327 East Grove St., Phoenix, AZ 85040.

Another company that I had the chance to visit is CALCOMP. This is a company that many of you probably have not heard of since they have been primarily in the large mainframe and graphics business. They do build memory systems in the form of large disk and floppy disk systems, with sales primarily directed to the OEM. Recently they have developed an S-100 bus compatible disk system and have made some inroads with quad density disk technology. Later this year we will be publishing an indepth article on the CALCOMP disk systems and how they fit into the small business market.

Last but definitely not least is a total systems house called DEMARCO-SHATZ. This company, located in Manhattan Beach, California, has been primarily dedicated to the design of custom software.

The company was started about four years ago by Daryll Shatz and Frank Demarco primarily as a consulting business for the DEC and Data General minicomputers. Two years ago they became involved in creating custom software for microcomputer systems and developed many optimized packages for their clients.

In the past several months they have developed an extremely powerful general business software package designed for retail dealers and OEMs that are marketing small business systems.

The packages are written in OPUS/THREE, a stack oriented form of BASIC that makes it possible to avoid repetitious programming tasks.

The business package has inventory control, sales entry, accounts receivable, accounts payable, purchasing, general ledger and a data maintenance program to control files and data. Termed GBS 1000, the business package is compatible with all major micro systems.

Along with their software developments they are preparing to launch a unique marketing approach to small business users. Working with a major microcomputer maker to be announced later, they have created the Finished System Concept.™ This concept is exactly that: a total complete system.

DEMARCO-SHATZ will be supplying the complete business system, including mainframe, disks, work station, printer, and all necessary items such as paper, ribbons, forms, etc. as a one package item. Maintenance and initial setup will be provided by Sorbus Inc., a major national service organization.

The goal is to provide the best possible service and product available to the market today. For retailers and OEMs that are interested in learning more about the Finished System Concept™, contact: Daryll Shatz, DEMARCO-SHATZ, 952 Manhattan Beach Boulevard, Manhattan Beach, CA 90266.

COMING SOON

Many of you have requested an index to hardware and software to be published in the pages of INTERFACE AGE. Coming in the October issue we will present our first annual index to hardware for the small business. It will be followed in November by an index of software, from systems software to applications.

—carl

Is your TRASH FLOW higher than your CASH FLOW?

SOFTWARE LIBRARY

Five diskettes are included to give you immediate operating and programming capabilities.

DISK 1 is a master diskette with BASIC, MDOS, Text Editor, Assembler and more!

DISK 2 has many games including LUNAR, CRAPS, and SPLAT. There's room left for you to add your own.

DISK 3 contains a Small Business Accounting package which includes Accounts Payable and Receivable, Inventory, a General Ledger, and more.

DISKS 4 & 5 are blank so you may add your own programs.

Clean it up with a VERSATILE 3B™

If you're a businessman, we know how difficult it is to keep neat and efficient accounting records. Let our VERSATILE systems do it for you. You'll have a complete system built into a single cabinet, and a free software library on diskette to get your computer working for you the first day. $3295 Assembled and tested.

WHAT ELSE DOES A COMPLETE SYSTEM NEED?

Contact Our Distributors for Regional Sales and Service

Alexander & Co., Inc.
5518 Florin Road
Sacramento, CA 95823
(916) 422-9070

Huron Electronics
415 N. Silver
Bad Axe, Mich. 48413
(517) 269-9267

The Computer Store
3801 Kirby Dr., Suite 432
Houston, Texas 77098
(713) 522-7845

Southeast Representative:

Scientific Sales Co.
175 W. Wieuca, Suite 210
Atlanta, GA 30342
(404) 252-6808

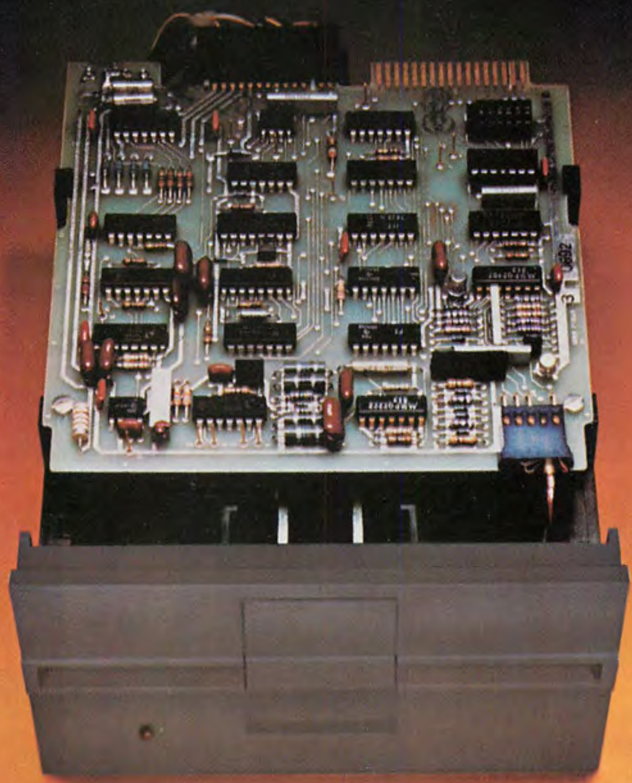
Dealer Applications Available.

COMPUTER DATA SYSTEMS

5460 Fairmont Drive • Wilmington, Delaware 19808 • 302-738-0933

CIRCLE INQUIRY NO. 7

If it isn't Shugart, it isn't minifloppy.™



Shugart invented the minifloppy in 1976. Today there are more than 100,000 of the little drives in use. That's because users want the affordable random access data storage of the minifloppy.

Shugart packs years of proven floppy drive technology into this tiny package. Up to 110 kbytes of data storage. Fast random access of about one-half second. And high speed data transfer of 125 kbits per second. Plus sensible, maintenance-free features like write protect to prevent accidental data loss, an activity light to indicate when the drive is selected by your computer and a door interlock to protect your media from damage.

Our proprietary read/write head provides maximum data interchange margins, and it is positioned precisely on the selected track by a patented spiral cam actuator. The DC drive motor with integral tachometer assures accurate diskette rotation and low heat dissipation. A die cast aluminum base plate provides a solid foundation for the drive.

At Shugart, technology leadership is more than a slogan, it's a commitment. Get reliability and value when you invest your money for floppy disk storage. Ask for the standard of the industry. minifloppy. If it isn't Shugart, it isn't minifloppy.

Shugart Associates

435 Oakmead Parkway, Sunnyvale, California 94086

CIRCLE INQUIRY NO. 46

See opposite page for list of manufacturers featuring Shugart's minifloppy in their systems.

TM minifloppy is registered trademark of Shugart Associates

THE COLUMN

By Sandra Evans

IMAGINE: THE COMPUTER

Clunk, clunk, fizz, zap. Transported suddenly from your warm, amber living room into the streamlined lights of the future. Computer World. Terra Basic. *Earth With Digitals.* You, excited, anticipate the scholastic voyage you are taking into the realm of education — a place with unlimited computers, timeless learning.

Is it pleasant? Yes, it is! You find yourself in an endlessly large room, computers looming like library book shelves when you were a child. You gaze, then gawk.

Amid the silver-gray-blue you see your favorite computer, slightly sagging in its familiarity like the old fireplace chair you've come to depend on. The recognizable, the comfortable, among bright new shiny machines! The ones you've always dreamed of programming. There's the Altair; and the TRS-80; and the Commodore PET!

And there, in the file cabinet corner, crouched insignificant, is The Keeper. The computer librarian who speaks seven different languages, including PILOT, BASIC and FORTRAN. He exists pleasantly amid unevenly stacked, slightly swaying, dusty-musty valuable disks. Accordians of programs: ragged, yellow with precious flow charts.

A dream? Who cares!! "I want the program for the circling Lissajous figure!" you shout. (You know Beethoven will filter through the room when the silver figure sensuously floats across the screen.)

Next you demand, "The Star Trek Game, *please, and* the Pong Game, *and* the Sentry Game, *and* the, *and* the, *and* the. . ." The excitement! You, small and ecstatic, weaving and dodging the towering, smiling computers. Look, *Look!* There's the one you plan to buy next! There's the one you dream of owning 10 years from now! And *look!* There's the one you only fantasize about! You could *never* own it, but now, *now* you can play with it. You go, sign on and begin, pounding keyboard, swaying back and forth, with one hand poised and ready to swing down like a kid enveloped in his piano practice.

I can see you, yes. The camera dolleys back and there's a pale green irridescent glow filtering through the room, and you are happy, happy, learning. . .it's true.

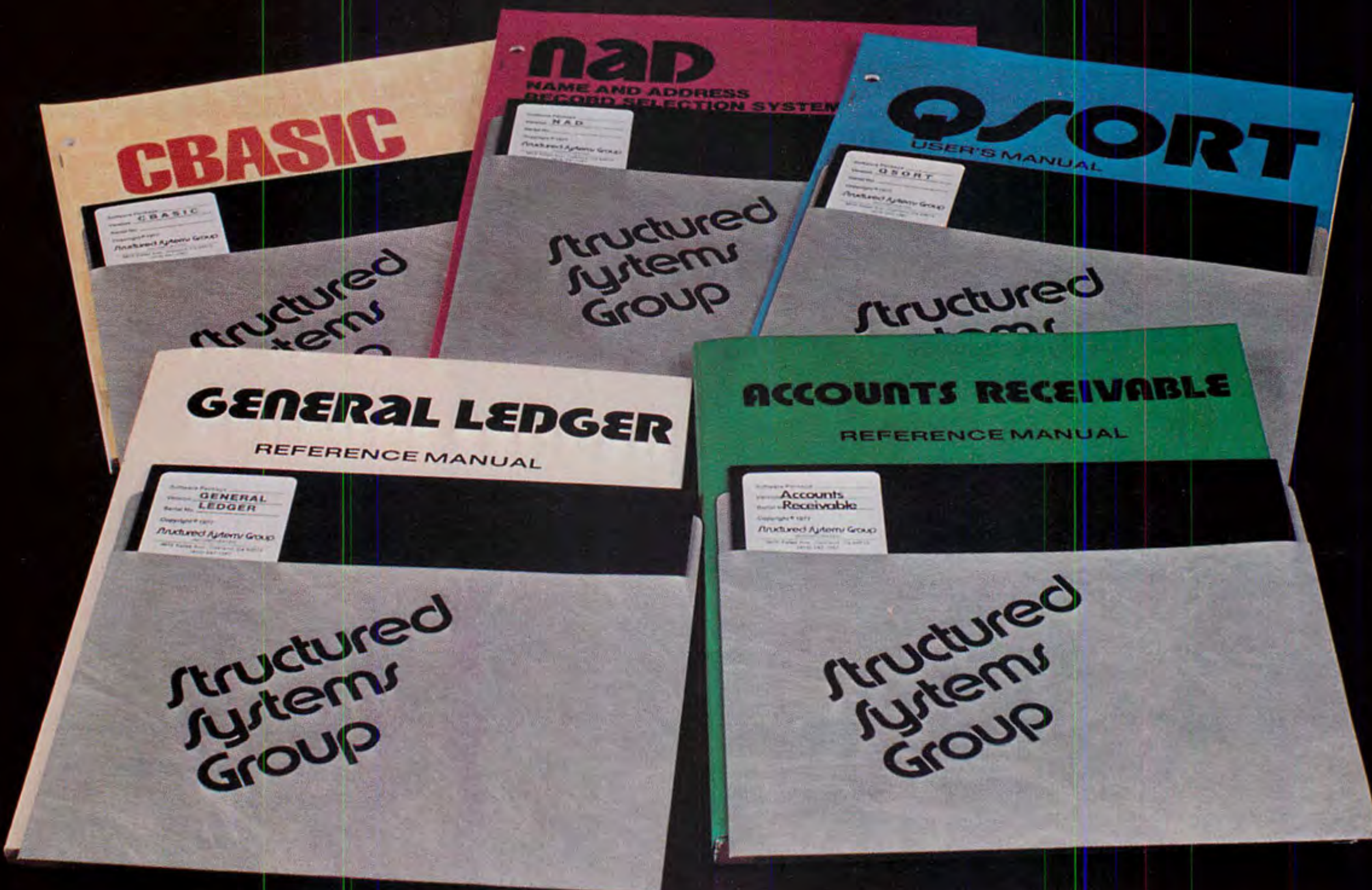
But something happens. The scene is out of focus, the picture blurs, melts. It changes, drastically, and now a new scene appears, the camera takes a different angle. The room is cold, peg-board, fade-yellow, and very, very dull. You are in a cubicle. *A cubicle.* That isolated, pressurized claustrophobic tomb. A place where gravity is 10g's, and you are buried underneath everywhere you'd rather be. You sit. On a chair that never has cushions. It's always plastic. *Hard* plastic. You stare at a computer: steel-bullet blue: impossible to curl up with; and everything is cold, hard cold. Your elbows hurt, seat aches, eyes droop. You still have 3 hours left of homework assignments. Questions to ask a machine which pops letters horizontally from left to right, and if you input the wrong word, it can't even figure out what you want! A dream? *A nightmare!! You can't even type!!*

And The Keeper? The Keeper is a grad assistant, skinny, straight-stringy hair parted on the side, who speaks seven different languages, including PILOT, BASIC and FORTRAN. But he can only follow directions. *"Those are the rules. It's ALWAYS been that way, THAT'S WHY!"*

Education? The first scene or the second? Neither, really. None of us can judge from our past times and prejudices. What then? A computer in education is exciting, inspiring, engrossing. It is also . . . "The Box." Monotonous metronome of block letters drumming out a language without adjectives. But the important thing is "The Box" can be used in education in the most useful manner. How? With imagination. *Imagination!* The most important asset a teacher can have. Imagine: What can the computer do? How can it be used? In what kind of environment should it be placed? Who should use it? Why should it be used?

These are basic questions faced by anyone using a new technique in class. But once a teacher is beyond justifying the computer, what is to be done with it?

"Our goal was to produce 100% reliable business programs."



"What do we mean by reliable programs? Three things: good program design, documentation, and full support.

DESIGN Good program design meets a wide variety of customer needs without reprogramming.

Keith Parsons, President
Alan Cooper, VP, Systems Development

CIRCLE INQUIRY NO. 52

Our programs are comprehensive yet retain their flexibility. They allow convenient backup, are easy to use and have been thoroughly tested and field proven.

DOCUMENTATION We consider the quality of the documentation to be as important as the programs themselves. That's why our manuals are clear, concise and complete.

SUPPORT And when it comes to support we're second to none. We release periodic updates, answer your questions and are available to provide technical assistance. Now *that's* reliable."

Our growing Business Systems series currently includes: **GENERAL LEDGER, ACCOUNTS RECEIVABLE, NAD** (Name and Address File system), **QSORT** (full disk sort/merge), and **CBASIC** (a powerful business Basic). For details, contact our sales manager, Richard Ellman.

Structured Systems Group

5615 KALES AVE. DEPT. IA6 OAKLAND, CA 94618 (415) 547-1567

All systems are compatible with any Z-80 or 8080 CP/M™ system.

Yes, we know the computer can drill. Teach a math concept: send student to computer. Computer presents student with practice problems. Student learns by repetition: repetition, repetition, repetition. Obvious. It's already been done. What else?

Games? Name the Person. Guess the Event. Figure the Word games. Algebra, anyone? I dare you to find X. Again, obvious. Games are fun and entertaining but of such limited use. Students should expect more from a computer than drills and puzzles.

And *please* don't tell me you can tie into a larger terminal and reproduce poetry, *short stories,* **EVEN NOVELS!!** There is something romantic inside that won't allow me to accept that. I can't fall asleep, glasses on my nose, computer on my chest.

This is not a huggable thing; it has sharp edges. However, it also has the ability to wrap itself around your brain and hug your mind with both challenge and concern. After all, what else can be programmed to help you solve the most earth shaking problems, then reply with, "Sorry, try again," when you input the wrong answer?

With the unlimited capabilities of the computer soon to be facing all of us, how do we keep it from being so mundane? We are the answer. We who picture the computer as anything from the ultimate toy to the ultimate drudgery. It is us. And our imagination. Dream for a moment. Run wild. Imagine a computer which could help you create poetry by offering synonyms for every word in your inexperienced phrases. Imagine a computer which could help you create a planet in its totality: one which meets your every specifications, then gives you the consequences of every scientific fact you have programmed. What you could learn! What about a computer who spoke to you as Thomas Jefferson? Or what about a bi-lingual computer? And here it is. Imagine being able to program "the other" team's football plays, then analyzing them for patterns, weaknesses, probabilities. Amazing! Amazing, but true.

It can happen; it's going to happen. If you're dreading it, you only have a few good years left. If you're anticipating it, *rejoice.* And prepare. The computer can lock us into grayfog monotony, and it can open us up to creative invention. It only depends on how we plan to accept it.

Whatever we decide, however, we need to plan now. Few in the education field are totally aware of the "impending revolution," and few understand the computer's uses. Now it is simply a small machine, available to correct the score sheets from our latest exams. But it will soon impose itself upon us as if to say, "Here I am. What are you going to do with me?" Will you use it? Can you? You can. Just imagine! □

CALL FOR ARTICLES

We are always looking for well written articles on any aspect of microcomputing. Specifically, however, we are interested in stories dealing with micros in telecommunications, music, small business, education and robotics.

All articles must be typewritten and double spaced on 8½ by 11 paper and written in the third person. Please no "conversation" or "neighborhood" stories. Page 32a of the March 1978 issue is the style guide for submitting articles and is beneficial to writers and editors if it is followed.

Accompanying photos should be well focused and must show good composition, contrast and balance. Program listings **must be** printed with a new ribbon or they cannot be reproduced.

Send your articles or ideas to: Carl Warren, Senior Editor, INTERFACE AGE Magazine, P.O. Box 1234, Cerritos, CA 90701. Please do not send articles with a copyright as we will not accept them. □

DYNABYTE COMPUTERS IMPLEMENT NEW DISK DRIVE CONTROLLER TECHNOLOGY

A new line of microcomputer systems from Dynabyte introduces a disk drive controller that increases the choice of disk storage configurations.

Top of the line is the DB8/2 Computer System, which offers up to 1.2 megabytes of mass storage on two 5-inch drives. It uses 77-track Micropolis disk drives and with Dynabyte's new controller offers double or quad density in single or double sided configurations — up to eight times the capacity of single-sided, single-density 5-inch drives.

To implement the drives, Dynabyte developed its Dual Density Floppy Disk Controller. It is the first disk controller capable of handling a variety of 5-inch 8-inch drives in dual density on either one or two sides. To permit expansion of the system as the user's needs increase, the controller is capable of handling up to 16 drives.

The product line's self contained disk storage capacity, flexibility and expandability was developed by Dynabyte for business, professional and scientific applications.

Dynabyte's exclusive Dynamic Data Compensation yields a double density error rate comparable to single density rates. Dynabyte is using the module exclusively in its computer systems.

The DB8/2 includes a 4MHz Z-80 microprocessor module on 8-layer PC board that also includes two RS232 serial I/O ports, one parallel I/O port, an EPROM programmer, two TMS2716 PROM sockets, vectored interrupts and a real time clock.

The unit has 32K of RAM and the Disk Controller in a 12-slot motherboard fully populated with mil-spec connectors. It uses a regulated power supply designed to comply with U.L. approved standards.

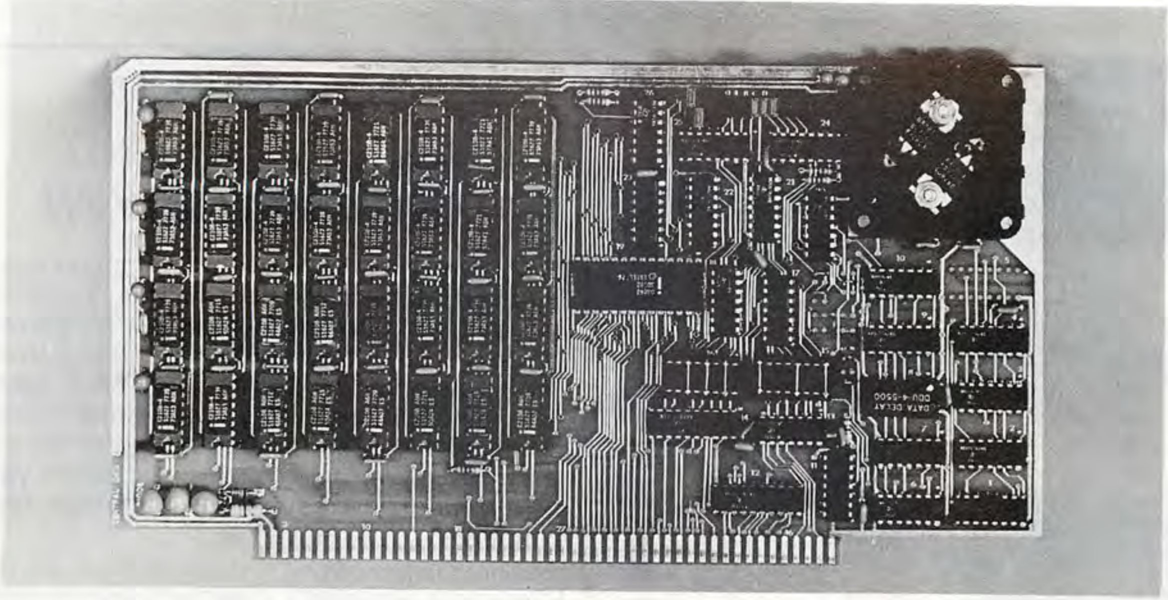
The DB8/2 enclosure incorporates the same design and construction techniques used in the most popular electric office machines — aluminum castings, deckled finish and subdued colors appropriate in an office environment.

CP/M Disk Operating System* was chosen for the Dynabyte systems because of its wide acceptance and available software. Initial language and software packages from Dynabyte include BASIC, FORTRAN, COBOL, word processing, general ledger and accounts receivable, with more package software to come.

Dynabyte is also introducing the DB8/1, a Z-80 computer with no mass storage, and the DB8/4 Floppy Disk System with two 8-inch disk drives with up to two megabytes of storage.

A product brochure is available from a Dynabyte dealer or Dynabyte Inc., 1005 Elwell Court, Palo Alto, California 94303, (415) 965-1010.

*CP/M is a trademark of Digital Research.



We Start With A Price That's Hard To Beat.

But We Don't Stop There.

Central Data Corporation has combined the benefits of new technology and high-volume company sales to bring you a RAM board with more features and product options for less money.

Lower Prices More Memory Capability

To begin with, we've reduced the price of our 16K RAM board by $40 to $249. At $425—a price reduction of $50—our 32K board costs less, too. Plus, we now offer a full 48K memory board for $599. These boards are expandable to 64K at a price of $185 per 16K package. Or you can start right out with a full 64K board for $775.

Improved Board Design

We've also added improvements to the board design at no extra cost to you.

- **Deselectable in 2K increments.** Our deselect feature enables you to switch off any 2K to avoid overlap with your existing memory.
- **Fully socketed memory.** This feature enables you to expand the memory board yourself.
- **Plug selectable addressing.** Now you can re-address without soldering

Other Standard Features

- Power-saving dynamic board with on-board invisible refresh
- One-year guarantee on parts and labor
- S-100 and Z-80 compatible

Specifications

Storage Capacity	16K, 32K, 48K, or 64K
Addressing	16K boundaries
Max. Input Load	One LS TTL load
Output Buffering	On all data lines
Access Time	450ns
Cycle Time	480ns
Wait States Generated	None
Maximum DMA Rate	1 Mhz

CIRCLE INQUIRY NO. 6

Power Consumption

+16	150ma
+ 8	300ma
−16	20ma

Other Products From Central Data

Central Data also offers, fully-assembled and in kits, a range of other computer products including (pictured above) our 2650 microprocessor, software packages, TV/Monitor, ASCII keyboard, and (not pictured) floppy disk system, to name just a few.

For More Information To Place an Order

We welcome any questions you have about our RAM boards or other products. To place an order, or for more information contact:

Central Data Corporation

P.O. Box 2484, Station A
Champaign, IL 61820
Ph. (217) 359-8010

Place orders prepaid or COD. Delivery is stock to 30 days with shipping and handling prepaid in Continental United States. Please include phone as well as name and address.

CALIFORNIA BUSINESS AND INDUSTRY SHOW

Thirty-five Top Mini and Microcomputer manufacturers and dealers will be exhibiting in the diversified California Business and Industry Show, September 19, 20, 21, 1978 at the Anaheim Convention Center (across from Disneyland). Show hours are Tuesday and Wednesday, September 19-20 from 11 a.m. to 8 p.m., and Thursday, September 21 from 11 a.m. to 6 p.m. Your business card admits *you free.*

Following is a list of the computer oriented exhibitors:

Accounting Datamation
Adventures In Computing
American Microcomputer Corporation
Anaheim Business Machines
Applied Data Communications
Billings Computer Corporation
Burroughs Corporation
Business Automation
Byte Shop
California Micro Products
Command Computer Service
Commercial Micro-Systems
Compath
Computall Corporation
Compucorp
Computer Interface Technology
Computerland
Computer Power and Light
Computer Systems Unlimited
CPT California, Inc.
Expansion Techniques Systems Trust
Findex
Loumar Management Systems
Management Sciences America
Microcomputers
Dan Nay Associates
Newport Data Systems
Omni Computer Corporation
Philips Business Systems, Inc.
Royal Business Machines
Sperry Univac
Terminal Brokers
III Phase Computer Service
Vector Graphic

LETTERS TO THE EDITOR

Dear Editor:

Our involvement with the S-100 standardization committee began early this year. Two members of the IEEE task committee on Microprocessor Standards headed by Bob Stewart had begun the enormous task of characterizing and generalizing the defacto bus behavior of more than 300 boards all claiming to be S-100 compatible. At this time no manufacturer of S-100 boards had published or included in their documentation packets timing descriptions of "their" S-100 bus, and yet these two individuals, George Morrow of Thinker Toys and Howard Fullmer of Parasitic Engineering, had somehow arrived at an extremely perceptive generalization of the basic 8080 timing, from which the S-100 was originally derived, and a redefinition of the 100 bus lines that eliminated numerous redundancies and conflicts.

Gertrude Stein once wrote that "a leader is someone who leads you where you don't want to go," and that is exactly what happened to me. When I received their first specifications, I tacked their basic Bus Cycle Timing to my wall and drew timing charts for all the relevant processors to the same scale, tacking them underneath. My objective was to achieve processor independence in the basic bus cycle. This was more easily accomplished than I had first imagined, and with relatively minor changes to the proposed cycle, I had proved to my satisfaction that almost any processor could be interfaced to the S-100 bus, and meet the basic specifications. But that is only half of true processor independence: True independence means that any processor may be interfaced to the bus *without penalty,* and it was only much later, in a hotel room the evening before the symposium at the Second West Coast Computer Faire where both the Morrow/Fullmer paper and our first draft were to be presented, that we arrived at the idea of a Status Strobe, achieving our goal.

The first draft of this paper was written as the result of a series of meetings with the design staff at Ithaca Audio, and numerous brainstorming sessions with its president, Steve Edelman. Our intention was two-fold: First, we wished to present the logic by which each specification was being made, both in terms of context and in terms of the specific tradeoffs involved, and second, to present a unified set of extensions to the basic specification that would hopefully span the bus requirements of future systems architectures. To this end we developed a modified interrupt protocol in conjunction with a multi-leveled DMA scheme, a protocol by which 16 bit parallel bus transfers are possible on the S-100, and by which *both* currently existing 8 bit masters and slaves, and 16 bit masters and slaves of new design may co-exist in the same bus, all masters having access to all slaves.

This second draft incorporates many changes that resulted from a series of very productive meetings with George and Howard and the rest of the IEEE committee during and after the West Coast Faire. At our meetings during NCC in June, two new proposals were brought under consideration: First, the wait acknowledge line, PWAIT, had been proposed for elimination. As specified by INTEL for the 8080 this line indicates that the processor has accepted a wait state, but the timing of this signal is so loose that the worst case appearance of PWAIT = TRUE may not occur until after the processor has finished its wait cycle and is completing its operation. This exceedingly loose specification renders this signal virtually useless for system design. Second, a general ERROR line had been proposed for inclusion. This line may indicate a parity error during a memory read,

CIRCLE INQUIRY NO. 4

write to protected memory, read or write to non-existent memory, etc.

The S-100 bus has come a long way in the last 6 months, and we seek publication now to offer our work as a sounding board to generate new proposals and expose our blind spots. We encourage your readers to criticize our work in detail and send written descriptions of problems and extensions to us. Much work remains to be done before these proposals become a standard: I am currently working on a paper that will show how a true multi-processing system may be implemented under the guidelines of the standard, a comprehensive description of the DC electrical characteristics of the bus needs to be written, and the extremely delicate political/engineering problem of where to assign new lines will require much vision and patience.

Kells Elmquist
Ithaca Audio
P.O. Box 91
Ithaca, NY 14850

MORE ON THE H9

Dear Editor:

I enjoyed the article in the June 1978 issue concerning the 24-line display for the Heath H9 terminal, and am seriously considering adding it to my terminal. However, before undertaking the surgery required on the boards, I tried to examine the logic used by the author, and it all seems to be in order. One point which did disturb me was the author's statement that 22 interconnection wires were required. I could only count 21 in the diagram, including the +5 volt and ground connections.

The question now seems to be, did the author mis-count, or was something left out of the circuit diagram as published? I will be waiting for an answer to this question before I attempt the modification on my H9. I shall watch future issues for any circuit corrections, or a reply from your magazine.

William C. Richter

There are only 21. We set 22.

ANOTHER ONE

Dear Editor:

I found the article, "A 24-Line

Display for the Heath H9", to be most useful since I, too, found the limited twelve line display to be frustrating. However, frustration also results in trying to implement Mr. Sama's conversion until one realizes that there is a small error in the instructions describing how to modify the character generator board. The instruction "Jump U221-2 to U219-11" should read "Jump U221-10 to U219-11".

The world of computers is new to me and I find your magazine a tremendous help in becoming acquainted with the many intricate details of this fascinating field.

John M. Higdon

Thanks, John. You helped us out quite a bit.

AND STILL MORE

Dear Editor:

The additional capability provided by your article "A 24-Line Display for the Heath H9" (June 1978) was greatly appreciated. Installing the modification took much longer than I had anticipated. One reason was due to an error in the article. The necessary correction information was obtained from INTERFACE AGE. I decided after a week of troubleshooting and not being able to locate the problem that I'd better check to see if any misprints had occurred in the article. Indeed there had! (U221-2 to U219-11 should have read U221-10 to U219-11) I was somewhat relieved to hear that there was an error because it is no picnic trying to troubleshoot the H9. I made the correction, very optimistic that I had the correct fix. Well, I installed the fix but things still weren't quite right. This leads to my next problem.

In Step 1 of the article Mr. Sama says to "Cut S202-3 to U213-7". This step may cause some confusion (at least it did for me!). Pin 3 of the PC board connector S202 goes to U216 and U212 before reaching U213. Because of this, I made the cut at U213. This isolates U213 from U216 and U212. The result is that the display is only 12 lines long in addition to being centered in the middle of the screen. This is due to the fact that the last 12 lines of video are being blanked and the vertical sync pulse is occurring twice as often as it should.

I believe that this problem could have been avoided had the step read "Isolate S202-3 from the RAM and COUNTER circuit board only". The cut can then be made at the connector and the jumper in the following step could be made directly from the PC board connector (S202-3) to U213-6.

I was able to realize the error I had made, only after having analyzed the logic circuits for several hours. I'm a EE, but not a logic designer so it took me awhile to understand what was occurring. I believe that Mr. Sama's intent was that anyone who had built the terminal should be able to install this modification, without having to analyze the circuit diagrams first.

I guess this is one of the reasons Heathkit is where they are today — their kit instructions are very explicit and seldom allow for misinterpretation. Mr. Sama was right, the additional capability was well worth my time and effort.

One other item, if you don't purchase the 2114 RAM chips from Heathkit you can cut the cost of this modification by almost 50%!!.

G.J. Schneider

We can't thank you enough. This 'mod' has had us really going, but many readers have advised us that once they found the errors, it works great.

Dear Editor:

With regard to Richard Arnold's articles on the Heath H8 — very well written and comprehensive, with only one (minor) error that caught my eye. The TED-8 text editor *will* operate in both upper and lower case simultaneously, if you happen to have a terminal with both.

I eschewed the H9 video terminal because of its limitations (which are quite needless), and bought a Lear-Siegler ADM3A with the lower case option. Therefore, I can perform word processing, to the limit of the text editor, in both upper and lower case.

If other readers are tempted to do the same, I recommend buying the Lear preassembled (the kit is a horror), and adding a couple of pounds of solder to the underside of the board.

I am interested in the development of better word processing programs, either in BASIC or in 8080 assembly language, to be used by the H8. If other readers are similarly inclined, or if anyone knows of good programs which are already available, please write to me.

Donald M. Chaffee
Meadow Lane
Wellesley, MA 02181

SHORT FORM PROBLEM EXPLAINED

Dear Editor:

I have received many letters concerning problems with the modification described in my article, "A 24 Line Display for the Heath H9", appearing in the June 1978 issue. Due to the tremendous variety of symptoms that can result from any one error in wiring in the new circuitry, it would not be practical for me to try to answer all letters with a possible solution to specific problems, considering the time that would be involved. Instead I shall make the following comments and offers to those who are having difficulty with the conversion:

1. First, I must apologize for an omission on my part. The following modification to the "RAM and Counter" board of the H9 must be included:
   a. Cut 528-8 to U515-10
      Jump U528-8 to U526-4
      Jump U526-6 to U515-10
      Jump U526-5 to U521-2
   b. Cut U528-11 to U530-13
      Jump U521-2 to U527-8
      Jump U527-10 to U530-13
      Jump U527-9 to U519-13

   Omission of these changes, however, would only affect the short form mode.
2. Aside from the above omission and the matter of the misprint correction described in a previous letter to INTERFACE AGE ("Jump U221-2 to U219-11" should be "Jump U218-2 to U219-11") the 24 line display *has been successfully* implemented by others directly from the article. I, of course, am using the fully functioning prototype.
3. I have prepared a circuit description for the modification to explain each phase in more detail. Along with Heath circuit descriptions and a scope one should be able to interpret any problem symptoms and methodically find the cause. To obtain this material send a stamped, self-addressed envelope to:
   Stephen Sama
   4006 Berrywood Dr.
   Seaford, NY 11783
4. Please do not write to me about specific problems except as a *last* resort. Read the circuit descriptions and check the circuitry again. If you are still in trouble, let me know, and I will try my best to suggest solutions.

Stephen Sama
Seaford, NY

We appreciate this update, since it created some problems for us. Also, Heath Company does not support the modification and cannot offer any technical support.

Dear Editor:

As an American temporarily residing in Europe, I appreciate your international outlook in your new column "European Interface". However, from the vantage point of London, England, I feel that the quality of this column is not up to the standard of the balance of your magazine.

It should be noted that Europe is not limited to Paris, France. Perhaps the European Interface column should be expanded to incorporate articles from other cities and countries.

Of considerably greater importance, however, is the viewpoint taken by Hans Drewitz and Roland Hesse in the May 1978 issue about European pricing. Good journalism should not include functioning as an apologist for a rapacious industry.

The microcomputer industry is younger in Europe than in the U.S. and must operate without a significant European semiconductor manufacturing base. Having acknowledged this, the price differences remain astounding. Four illustrative examples are:

Item	US Price	UK Price
Commodore PET 8K Sys	$795.00	$1171.21
Tandy TRS 80 4K Sys	599.00	900.90
Godbout Econoram II Kit	135.00	245.70
2111 AL 4 Memory Chip	4.10	5.10

These prices are all stated at the cur-

rent exchange rate and were not selected to maximize the discrepancy.

The explanation offered by Drewitz and Hesse is not adequate for the 50% to 100% price difference which can be observed. Their column presented unfavorable differences in seven factors. These factors, the authors' and my estimates of their value are:

	Authors' Estimate	My Estimate
transportation cost	10%-30%	(i) 5%-15%
importation cost	7%- 9%	7%- 9%
exchange rate considerations	10%	10%
cash flow	-	(ii) negligible
computer store cost	high	(iii) negligible
sales tax, and	11.5%-17.6%	(iv) 0%
price/volume sensitivity	high	(v) negligible
Total	44%-83%	24%-38%

The bases for my estimates are:

(i) I had two Econoram II kits air mailed for 3.1% of the retail price — and I have discussed this with air freight forwarders.

(ii) The cash flow impact is negligible, since air freight is used to minimize transport delay — and VAT is due within three months of the sale, not at the time of importation.

(iii) The prices I have quoted are for the United Kingdom—which requires no translation and has lower labor costs.

(iv) The prices are quoted before tax.

(v) Price/volume sensitivity works both ways.

It would be interesting to see if Drewitz and Hesse can provide a better explanation of the European/U.S. price differences than simple inefficiencies and price-skimming.

Ronald J. Subler
London, England

Very interesting to all of us. Thank you.

Dear Editor:

Our company operates essentially like a computer shop in your country, our goods come mainly from computer manufacturers. After writing to over 80 microcomputer manufacturers, hardware and software shops, we wish to express how we feel towards the microcomputer industry:

(a) Micro manufacturers are generally more responding towards trade inquiries. However, the personal touch is normally lacking with the exception of Micromation which is the only company to bother to reply personally to our queries. However, only a few are interested in international trade.

(b) Peripheral manufacturers and hardware vendors will generally send you their product catalogs, but when it comes to dealing, you will hardly hear from them again. The conclusion derived is that most do not bother about international sale.

(c) When we failed to obtain the required hardware from those listed in (b), we have only one way left, that is the computer shops. We found that the computer shops are ill-mannered when it comes to business inquiries. 95% of the shops simply chose to ignore the inquiries and did not reply at all. And among the only one that did reply, they did not indicate if they are interested in overseas sale.

A successful retail business requires the availability of a wide range of goods and the same applies to our company. We have tried in vain to locate a computer shop who is interested in international sale to give us a wider support of hardware requirements. We deeply appreciate if you would let us make use of your precious column to appeal to any computer shop operator who intends to exploit the oversea market to contact us. Our address is Microsystems Engineering, 7 King's Walk, Singapore 10 Singapore.

Y.T. Lam
General Manager

This would seem to be an excellent opportunity for someone interested in developing overseas trade. So please respond to Mr. Lam.

UPDATE

CHICAGO TO HOLD COMPUTING EXPO '78

The second annual Midwest Personal Computing Expo, October 5-8, 1978, will be held at the Expocenter in Chicago. Exhibitors are expected to number 150, and the show is expected to draw more than 20,000 computer enthusiasts.

A practical seminar program accompanying the exhibition will provide basic how-to instruction for beginning computer users as well as offer advanced-technology information for experienced programmers and operators. Special assistance will be given managers of small and medium-sized businesses in meeting their computer needs.

For discount admission details and further information contact Midwest Personal Computing Expo '78, 222 West Adams St., Chicagp, IL 60606, (312) 263-4866.

MAGAZINE ON CASSETTE

A new, monthly "magazine" on cassette is being offered to owners of PET computers at $27 per year. On side 1 of the cassette is a more or less standard magazine format (except that the text is read on the CRT instead of the more historical, traditional paper). There are numerous articles, reviews of peripherals and software, applications, programming hints, etc., relating to the use of Commodore's PET.

On side 2 there are three to five (or more) games and household or business programs each month.

Those interested may subscribe by writing to: PROGRAM, P.O. Box 461, Philipsburg, PA 16866.

BOSTON EXPO

The Boston Computer Society presents "Home/Business Computers '78. . .An exposition of the state of the art in microcomputers." The show will be held at The George Sherman Union at Boston University, 775 Commonwealth Ave., Boston from 10:00 a.m. to 5:00 p.m. on October 7, 1978.

"Home/Business Computers '78" will feature computers available for use, guest speakers and varied demonstrations. The show will provide an introduction for people interested in inexpensive microcomputers for home and business applications and will offer an opportunity for computer users to learn more about the latest microcomputers available.

Admission to "Home/Business Computers '78" will be $2.00 for the general public and free for Boston Computer Society members (BCS membership is $5.00 per year). A special discount coupon, entitling attendees to a $1.00 admission, will be available at The Computer Warehouse Store, 584 Commonwealth Ave., Boston beginning September 1.

For more information call 884-7291 or write The Boston Computer Society, 17 Chestnut St., Boston, Massachusetts 02108.

CALIFORNIA BUSINESS & INDUSTRY SHOW

A conference series designed for both prospective and established small business owners will highlight the 4th Annual California Business and Industry show to be held at the Anaheim Convention Center, September 19-21, 1978.

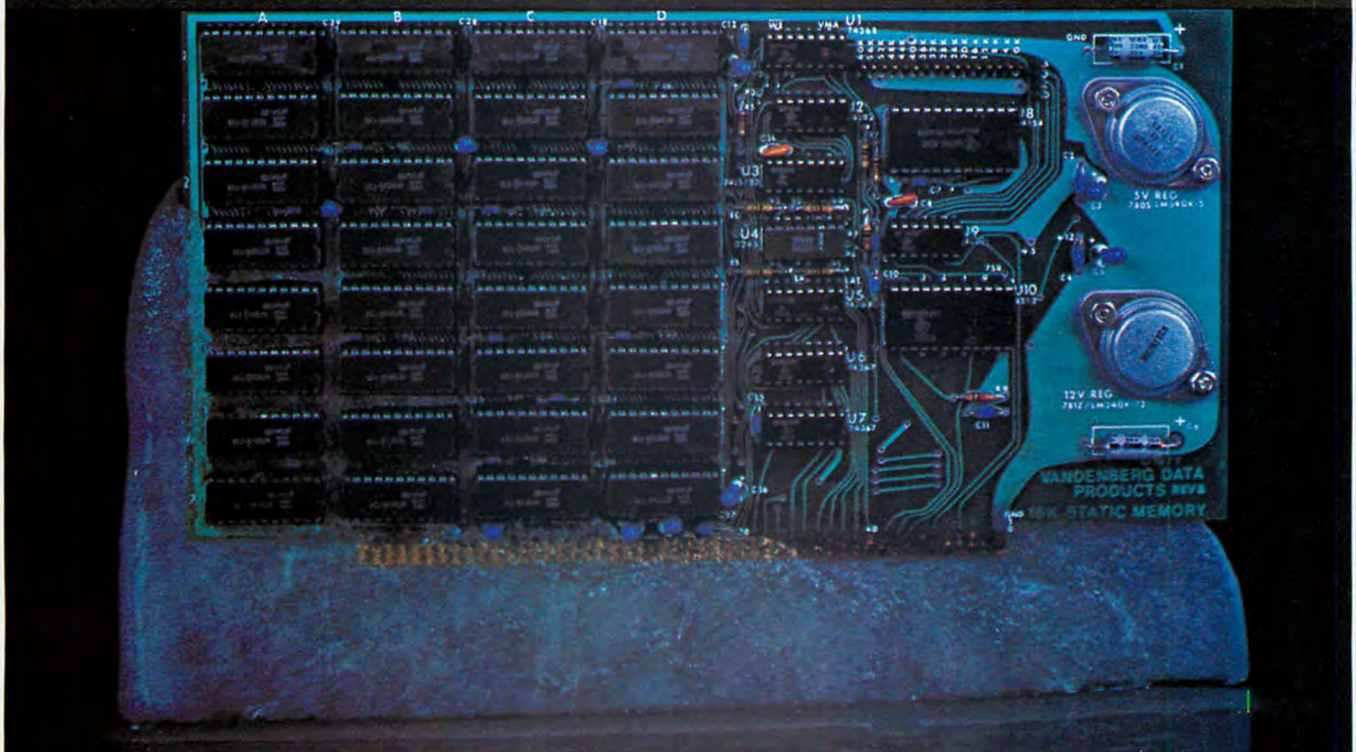
Co-sponsored by the U.S. Small Business Administration and SCORE of Orange County, the series will

CIRCLE INQUIRY NO. 60

THE COOL ONE

From
Vandenberg Data Products

16K Static RAM



$330 Kit $365 Assembled

COOL Features:

Each 4K block addressable to any 4K boundary; fully buffered (and compatible) S-100 bus; NEC μPD 410D memories (200 nsec access time); fully socketed.

COOL

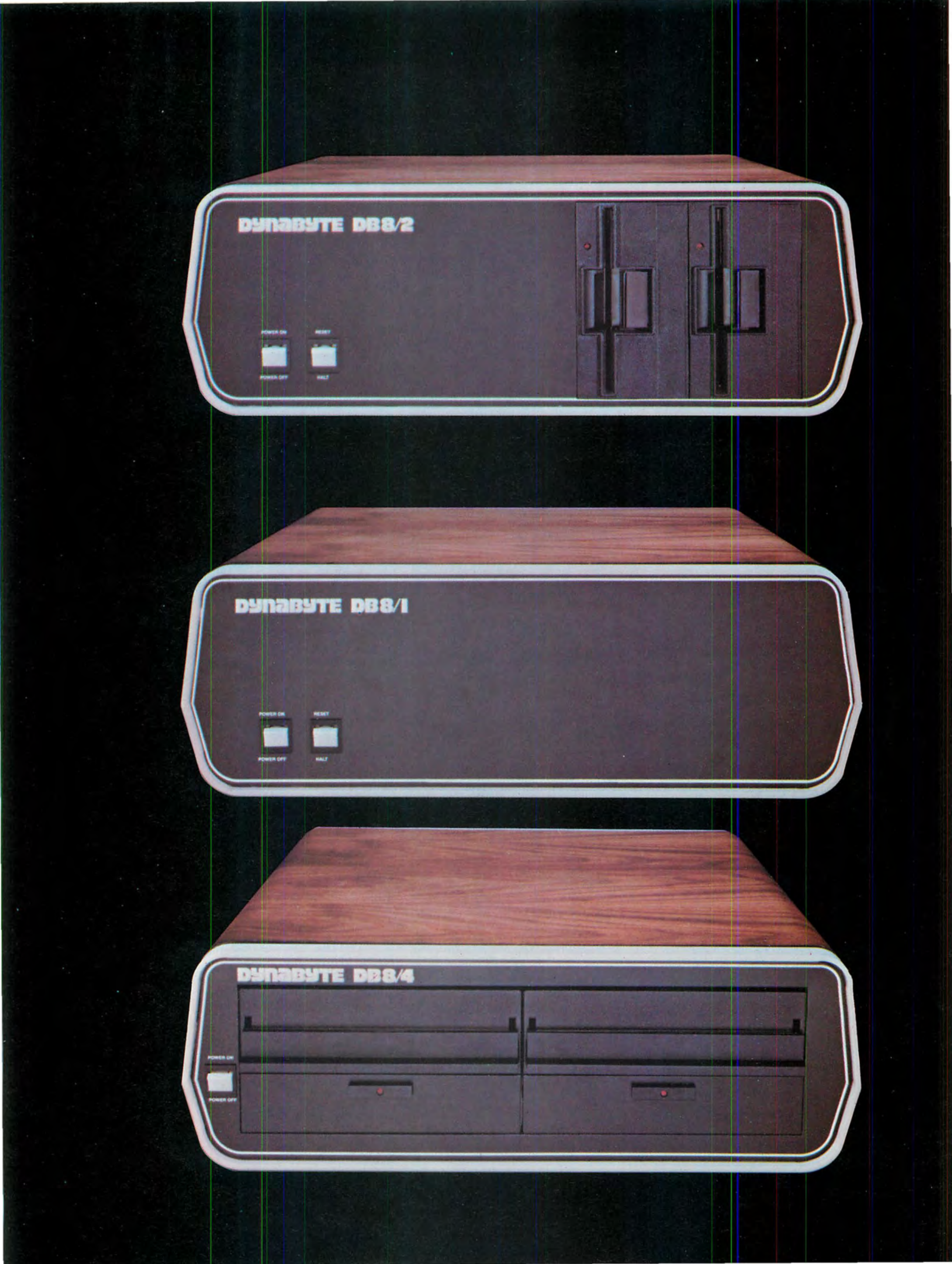
means less heat, low power consumption and sound engineering and design.

COD, Mastercharge, B of A, VISA accepted. Orders shipped prepaid. California residents please add 6% sales tax.

VANDENBERG DATA PRODUCTS

PO BOX 2507
SANTA MARIA, CALIFORNIA 93454

805-937-7951


DYNABYTE DB8/2
POWER ON
POWER OFF
RESET
HALT
DYNABYTE DB8/1
POWER ON
POWER OFF
RESET
HALT
DYNABYTE DB8/4
POWER ON
POWER OFF

DYNABYTE COMPUTERS ARE ALL BUSINESS INSIDE AND OUT.

When we designed our new small business computers, we meant business.

As basic as that seems, it is unique. Just about every other microcomputer being sold as a small business system today was originally designed as a kit for hobbyists.

Every design decision was made with quality and reliability in mind. The result is dependable performance and a solid appearance for business, professional and scientific applications.

FIRST SMALL SYSTEM WITH BIG SYSTEM STORAGE

Many applications handle large quantities of information, so the DB8/2 uses two quad density 5-inch disk drives with our exclusive Dual Density Disk Controller for up to 1.2 megabytes of formatted storage. That's more capacity than two single density 8-inch drives.

If you need more storage, our DB8/4 has two 8-inch drives with up to 2 megabytes capacity, more than any other dual floppy disk system on the market.

OUR SOFTWARE IS BIG ON BUSINESS

Dynabyte helps you get down to business immediately. The DB8/2 is the first microcomputer to offer enough storage capacity on 5-inch drives to fully utilize CP/M,* the most widely accepted disk operating system. We also supply and support BASIC, FORTRAN and COBOL programming languages. Our applications packages include general ledger, accounts receivable, word processing and many other CP/M compatible programs.

Reliability is a big consideration in buying a business computer, so we built it in. Our edge connectors meet military specifications, the toughest electronics manufacturing standard. Our regulated power supply is designed to meet U.L. standards, which means the entire system runs cool and dependable. And our cast aluminum enclosures are rugged as well as attractive.

AND THE BIGGEST THING OF ALL

Customer support. Our support starts at the factory with testing and burn-in programs that assure the *entire* integrated system is reliable prior to shipment. Our completely modular design allows continuing support in the field. We maintain a bonded inventory of all sub-system modules which means we can deliver replacement subassemblies overnight nearly anywhere in the continental U.S.

Dynabyte built in little things, too. Like a fully-populated 12-slot backplane, switched AC outlets for accessories, an option for European power, quiet whisper fans with long-life metal construction, lighted indicator switches for Power On and Halt, a shielded enclosure to protect disk drives from electro-mechanical interference, and a fully enclosed power supply for operator safety.

Since we didn't cut corners in design, the price/performance ratios of our systems make good business sense.

THE INSIDE FACTS

The DB8/2 Computer System includes two 5-inch disk drives either single or double sided for up to 1.2 megabytes of mass storage; a 4MHz Z-80 processing module with one parallel and two serial ports, an EPROM programmer and up to 4k ROM; 32k of RAM, a 12-slot fully-populated backplane; our exclusive Dual Density Disk Controller, and CP/M.

The DB8/1 Computer includes a 4MHz Z-80 processor with one parallel and two serial I/O ports, an EPROM programmer and up to 4k of ROM; 32k RAM, and a 12-slot fully-populated backplane.

The DB8/4 Disk System, designed to be the mass storage companion to the DB8/1, includes two 8-inch floppy disk drives in either single or double sided configuration for up to 2 megabytes of mass storage, our Dual Density Disk Controller, and CP/M.

All three units will be available in rack mount models.

For a descriptive brochure and price list, call or write Dynabyte, 1005 Elwell Court, Palo Alto, CA 94303. Phone (415) 965-1010.

Or better yet, see your local dealer.

DYNABYTE

* CP/M is a trademark of Digital Research.

YOU CAN DEPEND ON IT.

focus on successful marketing techniques and sound financial planning.

Each conference will be comprised of a series of three lectures scheduled between 9:00 a.m. and Noon on September 19 and 20. The program for September 19 focuses on marketing and is entitled "Get Ready — Get Set — Sell!". The conference on September 20 will be "Walking the Financial Tightrope." Both are offered free of charge.

Aimed toward the end user market, the diversified California Business and Industry show will feature exhibits of business and industrial equipment, products and services. For further information regarding the show and conference series telephone (714) 558-0846.

CONVENTION INFORMATIQUE 1978

In Paris on June 5 it was by means of a "Face the Press" discussion that the organizers chose to introduce the 8th Convention Informatique, which will take place September 18 to 22 at the Palais des Congres in Paris.

This preview raised the curtain on the topic of the Convention Informatique 78, which will deal this year with The Insertion of Data Processing, A Key to Success.

48 working sessions will be devoted to this subject around two main lines of approach: *controlled management of data processing, means and methods* with networks, data bases and management as topics for discussion; and *data processing as a factor for progress, from the business enterprise to the private citizen.* This will be centered around four aspects, the options of the firm, applications, data processing in everyday life and tomorrow's data processing.

The opening meeting will be honored by the presence of Madame A. Saunier-Seite, Minister of Universities, and will be devoted to training and to the data processing professions under the title, Data Processing Specialists: Shortage? Unemployment?

Please note that like last year, the Convention Informatique invites its participants to get together after the sessions in order to promote individual contacts.

For the first time, German will be offered as a third working language to participants in addition to English and French.

COLLEGE STUDENT HOPES TO "HUMANIZE" COMPUTERS

Do Americans really fear computers as awesome and dehumanizing machines with uncontrollable powers?

A young college student in San Francisco believes they do, but he thinks that computers for the most part are taking a bum rap and intends to prove it, with the help of Signetics, a manufacturer of the small "computer on a chip" known as a microprocessor.

Robert Weber is designing a laboratory in which people will be able to "play" with today's small microcomputers and discover how the computer's memory and problem solving power can help them in numerous ways.

Assuming he continues to be persuasive with the manufacturers of the equipment he needs, Weber hopes to bring the project to fruition within three years.

If his dreams come true, one day soon not only San Franciscans but all Americans will be able to stop by one of these centers and get to know their friendly neighborhood computer.

COMPUTERIZED CLASSROOM AT INSTITUTE FOR COMPUTERS IN JEWISH LIFE

The Institute for Computers in Jewish Life announces the opening of its computer-augmented classroom. In the ICJL computer-augmented classroom a specially designed computer terminal called the Digi-Log Telecomputer II and a standard television monitor will make it possible for an entire class to participate simultaneously in computer related activities.

FULL SIZE FLOPPY DISK $995 COMPLETE!

DISCUS I™ full-size floppy disk system is an overnight success . . . because it's delivered so complete you can have it running in a single evening.

For just $995, it's a complete memory system. Complete with all hardware and software. Completely assembled. Completely interfaced. And tested as a complete system.

And you can not only solve your memory shortage faster, you can solve it longer . . . because DISCUS I™ is a full-size floppy system with 3 times the storage and 5 times the speed of mini-floppies.

Your $995 DISCUS I™ system includes a Shugart 800R full-size drive with power supply in a handsome freestanding cabinet, our 8-drive capacity S-100 controller with onboard buffer and serial interface, all cables and connectors, and all the software you need. Your software library includes DOS, text editor, 8080 assembler (all integrated in DISK/ATE™), our BASIC-V™ advanced virtual disk BASIC able to handle a wide variety of data formats and address up to 2 megabytes and patches for CP/M*. And it's all interfaced to your controller's serial I/O port to avoid I/O guesswork.

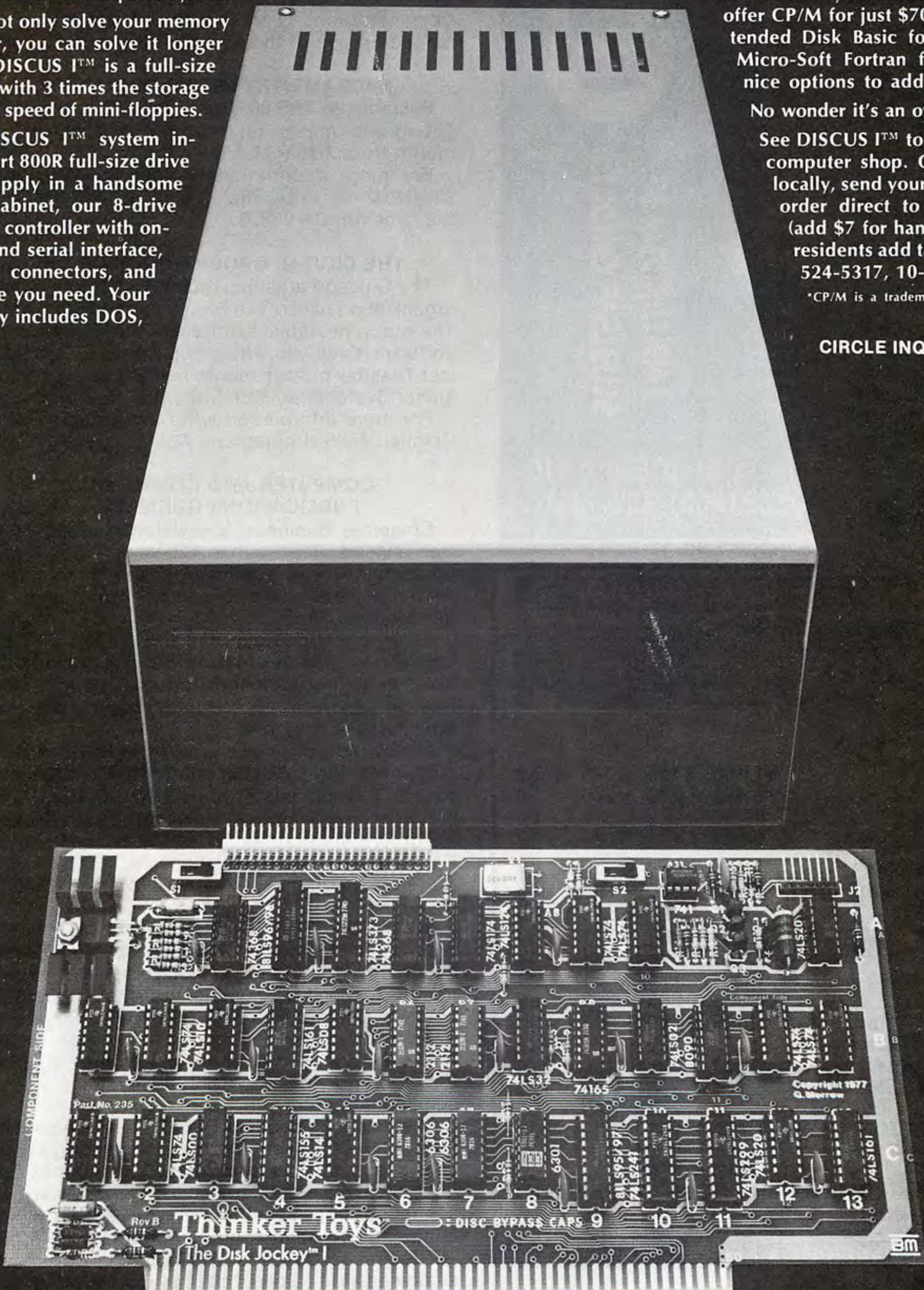
And it's all yours for $995. We even offer CP/M for just $70, Micro-Soft Extended Disk Basic for just $199 and Micro-Soft Fortran for just $349 as nice options to add to your library.

No wonder it's an overnight success!

See DISCUS I™ today at your local computer shop. Or if unavailable locally, send your check or money order direct to Thinker Toys™ (add $7 for handling; California residents add tax). Or call (415) 524-5317, 10-4 Pacific Time.

*CP/M is a trademark of Digital Research.

CIRCLE INQUIRY NO. 56



A product of Morrow's Micro-Stuff for

Thinker Toys™

1201 10th Street
Berkeley, CA 94710

The computer-augmented classroom uses a conventional telephone line to connect the Digi-Log Telecomputer II to a central computer facility. The computer print-out then appears on the television screen. In addition, one of the terminals in the computer center is equipped to provide print-outs in Hebrew and English.

On a per student basis this facility represents the most cost-effective approach to the use of computers as a tool of instruction. Pedagogically it provides motivation and a direct, positive learning experience. Demonstrations, workshops, and seminars can be arranged for use of the computer-augmented classroom.

SACRAMENTO USER'S GROUP FORMED

Sacramento TRS-80 User's Group has recently formed. The group meets on the first Wednesday of each month from 7-10 P.M.

For more information contact Sal Alestra at (916) 927-0237 or write the group at 437 Berthoud St., Sacramento, CA 95838.

THE DIGITAL GROUP GROUP OF CHICAGO

The Chicago area has recently acquired a new user's organization called The Digital Group Group of Chicago. The group provides a forum for the exchange of ideas, software, fixes, etc. The group meets at 7:30 P.M. on the last Tuesday of each month in the meeting room of Consumer Systems at 2107 Swift Rd., Oak Brook, Illinois

For more information write the group c/o William L. Colsher, 4328 Nutmeg Ln., Apt. 111, Lisle, IL 60532.

COMPUTER AND COMMUNICATIONS PUBLICATIONS GUIDE AVAILABLE

Computer Business, a newsletter supplying categorized reviews of more than 125 key articles from dozens of computer and communications trade publications each month, is now available from Contemporary Communications, Inc.

Each review contains the title of the article, a brief abstract, the source of the article, and a unique "Reader's Key" denoting its length, orientation and readability. Special editorial and production techniques ensure the timeliness of the content.

Annual subscriptions are $48 in North America, $60 elsewhere; the publisher will bill after the subscription begins. A three-month trial subscription is $12 (prepaid only). Master Charge or Visa charges are accepted.

For further information or a free sample copy, contact Contemporary Communications, Inc., 2909 Oregon Court, Suite C-11, Torrance, CA 90503; (213) 320-6599.

NEW COMPUTER COURSE FOR FIRST-TIME USERS

A self-instructional course providing information needed by first-time users of computers has been announced by INFO 3, publishers of audio-cassette EDP courses. *Computer Concepts for Small Business* covers basic computer concepts, including types of data and how they are processed, how systems are developed, the operation of implemented systems and how to select a computer.

The course is designed to aid business people to prepare for their first computer by presenting the prerequisites of sound business computer applications, and covering critical management decisions like security and personnel staffing. Specific steps are described for evaluating and acquiring computer equipment and software.

The course contains over two hours of instructional audio-cassette tapes, plus a workbook of over 200 pages. The price is $140.

For more information contact INFO 3, 21241 Ventura Blvd., Suite 193, Woodland Hills, CA 91364. Toll-free number is (800) 423-5205; in California (213) 999-5753.

TEN YEAR FORECAST OF GOVERNMENT MARKETS TO BE PRESENTED

The Electronic Industries Association will present its Ten Year Forecast of government markets addressing a broad cross section of government related plans, policies, forecasts and ideas on future electronic markets to a national audience at the Hyatt House Hotel, Los Angeles International Airport on October 24-26, 1978.

The EIA Ten Year Forecast of Government Markets is based on in-depth interviews with officials of DoD, OMB and Congress and is recognized as the authoritative source of information on the U.S. military electronics market.

SPHERE MICROCOMPUTER USER'S NEWSLETTER

The Sphere Microcomputer User's Newsletter is mailed six times a year. It contains hardware and software features of primary interest to Sphere microcomputer owners but also of great interest to any M6800 computer owner.

Subscribers should remit $12.00 domestic or $16.00 foreign to Programma Consultants, P.O. Box 70127, Los Angeles, CA 90070. Co-editors are Roger J. Spott and Jeffrey Brownstein, 13975 Connecticut Avenue, Wheaton, MD 20906.

PERSONAL COMPUTER NEWS

The Personal Computer News is a monthly newsletter edited by Donald L. Wallace, and is published from Dayton, Ohio.

PCN is dedicated entirely to a variety of reader services, and contains no paid advertisements. PCN features a regular news column detailing important developments in the microcomputer industry and related technologies; objective product and software evaluations geared to the small businessman and the hobbyist alike; a PCN-operated Software Exchange and a Trading Post classified advertisement section. In addition, a Software Sources listing culls the latest entrepreneurial offerings from the microcomputer media, and an Index to Computer-Related Articles cross-references features in the popular computerist magazines.

Subscription rates are $9 a year in the U.S.; $15 a year in Canada and Mexico; and $24 a year overseas. Personal Computer News, P.O. Box 425, Dayton, Ohio 45419.

COMPCON FALL '78 ADVANCE PROGRAM AVAILABLE

The advance program for COMPCON FALL '78, "Computer Communications Networks," is now available. The program consists of three tutorials and 27 sessions on Computers and Communications: Interfaces and Interactions.

COMPCON FALL '78 will be held at the Capital Hilton, Washington, D.C. from September 5-8, 1978. For a copy of the advance program write to COMPCON FALL '78, P.O. Box 639-P, Silver Spring, MD 20901.

THE POLY-HYPHEN-DISK USERS' GROUP (PhD.UG)

The Poly-Hyphen Disk Users' Group will cost $5.00 for ten newsletters (one year). Included in the newsletter will be information on the PhD.UG software exchange (i.e., programs available, needed, being developed). Each newsletter will have a review of a disk system and an explanation of how to hook it up to your Poly.

In addition, dependent upon space, some attempt will be made to answer group members' questions about their systems' bugs. Current Poly-disk combinations that are known to work well are Micropolis, North Star and Vista. There will be a nominal charge for copying software for members (no more than $3.00 per program) plus cost of a diskette if not provided by member.

If interested in PhD.UG, drop your name, address, system you're running, membership fee, and any comments/criticisms in an envelope to PhD.UG, c/o Thom Hogan, 719 Anna Lee Lane, Bloomington, IN 47401.

APPLE USERS GET ACCESS TO DOW JONES

Apple Computer, Inc., manufacturer of personal computers, has a new service which will provide owners of its computers with stock portfolio information and other financial services.

Using a telephone link up, users of Apple II Computers will be able to dial Dow Jones & Co., Inc.'s Stock Quote Reporter Service for fifteen-minute-delayed stock and bond quotations. This information along with software provided by Apple will enable the user to determine current portfolio value, short and long term gains, and rate of return, among other things.

The cost of the stock quote service will include a one-time fee of $25 plus a usage charge of $3 for the first three minutes plus 50¢ a minute thereafter for each usage session.

SEARCH FOR MICROPROCESSOR PRODUCTS

Byte Industries Inc. is looking for private labeled microprocessor products for small business systems and personal computing. If your company would like to discuss acquisition, royalties or private branding, write: Ken Olsen, Byte Industries, inc., 930 West Maude Ave., Sunnyvale, CA 94086.

CALENDAR

SEPTEMBER

Sept 24 Summit City Computer Club will meet at the McMillen Library on the Indiana Institute of Technology Campus in Ft. Wayne, IN. For details write the club at P.O. Box 5096, Ft. Wayne, IN 46805.

Sept 24 Birmingham Microprocessor Group will meet at Southcentral Bell Company headquarters bldg. at 2 P.M. For further details write or call Jim Anderson, 2931 Balmoral Rd., Birmingham, AL 35223; (205) 897-9630.

Sept 26 Okaloosa Computer Hobbyist Club will meet in the Santa Rosa Rm, in the Santa Rosa Mall, Mary Esther, FL at 7 P.M. For details call (904) 242-5938.

Sept 26 Sacramento Microcomputer Users Group, (SMUG), 7:30-9:30 P.M. at SMUD Training Bldg., on 59 St. Write Richard Lerseth, P.O. Box 161513 or call (916) 381-0335 after 5:00 P.M.

Sept 26 Computer Amateurs of So. Jersey will holds its meeting at the National Park Municipal Bldg., 7 So. Grove Ave., National Park, NJ at 7:30 P.M. For details call (609) 541-1010, or (609) 541-8296.

Sept 27 Ventura County Computer Society will meet at Camarillo Public Library, 3100 Ponderosa Dr., Port Hueneme, CA 93041 at 7:30 P.M. For more information write: VCCS, P.O. Box 525, Port Hueneme, CA 93041.

Sept 27 Diablo Professional Users Group (DPUG) will meet at Diablo Valley College Library, near the Willow Pass exit of Fwy. 680, from 8-10 PM. For details write or call Bob Hendrickson, Electronics Dept., DVC, Pleasant Hill, CA 94523; (415) 687-8373.

Sept 27 Boston Computer Society will meet at the Commonwealth School, 151 Commonwealth Ave., Boston at 7 P.M. The school is located on the corner of Dartmouth St. in Boston's Back Bay. For information write or call the society at 17 Chestnut St., Boston, MA 02108, (617) 227-1399.

Sept 28 Space Coast Microcomputer Club will meet at 7:30 PM at the Merritt Island Library, Merritt Is., FL. Contact Glynn Mills at R3, Box 904, Merritt Is., FL 32952.

Sept 28 Small Computer Engineering Association of Minnesota (SCEAM) will meet at the Resource Access Center, 3010 Fourth Ave. So., Minneapolis, MN 55408 at 7 P.M. For more information write to this address or call (612) 824-6406.

OCTOBER

Oct 1 The Computer Hobbyist Group will meet at 1 P.M. in the Green Center, Rm 2.530, of Univ. of Texas, Dallas. For details write to P.O. Box 11344, Grand Prairie, TX 75051.

Oct 1 Amateur Radio Research and Development Corp. (AMRAD) meets the first Monday of each month at 8 P.M. at the Patrick Henry Branch Library, 101 Maple Ave. E, Vienna, VA. for details write the club at 1524 Springvale Ave., McLean, VA 22101.

Oct 2 Minnesota Computer Society will meet at the Brown Institute, Room 51, 3123 E. Lake Street,

HEATH COMPANY

Benton Harbor, MI 49022

PLACE
STAMP HERE
Post Office
will not
deliver mail
without
postage

enjoy the world's leading electronic kit catalog...

FREE

THE ALL-NEW HEATHKIT CATALOG

Nearly 400 build-it-yourself kits that the entire family can enjoy

Send for your free copy today!

FREE YOUR COPY OF THE NEW HEATHKIT® CATALOG

featuring the world's leading line of kit and fully assembled personal computer systems* — from the world leader in top quality electronic products in easy to build kit form — nearly 400 kits in all, something for every interest!

You can also redeem this coupon at any of the Heathkit Electronic Centers† coast-to-coast where Heathkit products are sold, displayed and serviced. Check the white pages of your phone book for the store near you.

†Units of Schlumberger Products Corporation.

Send for your copy today

HEATH Schlumberger

Heath Company, Dept. 343-450
Benton Harbor, Michigan 49022

Please send me my FREE Heathkit Catalog.
I am not on your mailing list.

Name ______________________

Address ______________________

City ______________ State ______

CP-153 Zip ______

*Computer products include 8-bit and 16-bit computers, CRT video terminal, paper tape reader/punch, cassette or floppy disk storage, LA36 DEC Writer II Printer Terminal, Serial and parallel interfaces, software programs, a self-instruction microprocessor program with trainer, complete computer library and lots more!

Heath Company, Dept. 343-450 Benton Harbor, Michigan 49022

CIRCLE INQUIRY NO. 23

NEW FROM XITAN!
HIGH SPEED PRODUCTS TO UPGRADE YOUR CURRENT SYSTEM.

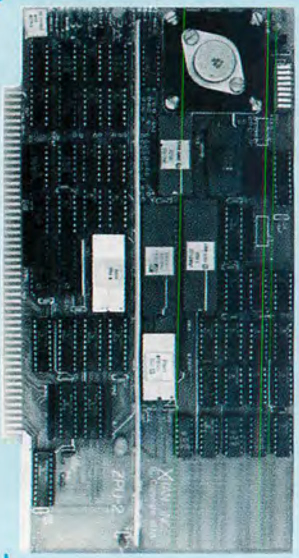
ZPU-2 — Using a 4MHz Z80A™ microprocessor, this board provides for full system support in any system. The on board clock provides for switch selectable 2 or 4 MHz operation and jumper selectable wait states generation for those systems where it is necessary to access memory or I/O interfaces. Jump-on-reset circuitry can initiate program execution at any 256 byte boundary.
TM-Z80 is a registered trademark of Zilog.

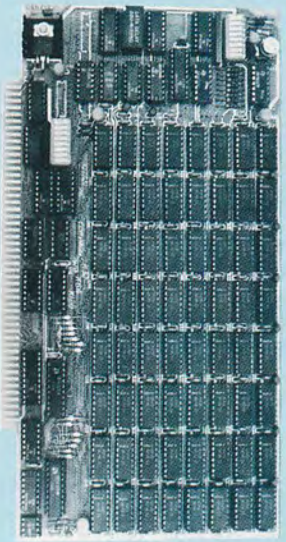
OPTIONS which will provide powerful system support include: memory mapping hardware to map 4K byte program segments into 1 Megabyte; four sections of 16 registers will provide for rapid context switching between four programs; four channel DMA controller; AM 9511 Floating Point Processor chip to provide high speed mathematical formulations for engineering or technological applications.

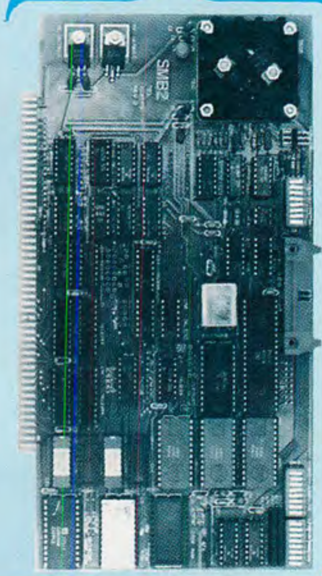
K Series DMB — 4 MHz Dynamic Memory Boards. Choose any of these four high density Memory Boards in either 32, 48, 64 or 128K bytes with low power consumption and fast operation using ZPU-2, without wait states. Cycle timing performed by precision digital delay line independent of S-100 Bus. Fully transparent refresh cycle is generated only when needed to help provide low power consumption. Extend addressing capability up to 1 Megabyte co-resident in system when used with ZPU-2. Superior noise suppression through use of molded ceramic bypass capacitors, power and ground grids and keeping trace lines to minimum length.

SMB-2 — System Monitor Board-2, a flexible multi function board providing circuitry to interface with commonly used peripherals. Wait State generation for 4MHz operation. Provides for Jump-To-Monitor on reset. Xitan's ZAPPLE MONITOR in 2K of MASKED ROM provides complete system control and extensive I/O manipulation. SMB-2 provides a cassette interface capable of 1200/2400 baud rate. Two RS-232 serial ports (one may be reconfigured for current loop), and an 8-bit parallel port with two control lines. Sockets for up to 4K EPROM (2708 or 2716. ONE 2708 supplied) and sockets for up to 2K RAM (1K supplied).

Interface One: an 18" ribbon cable connector which eliminates the handwiring of 26 wires to connect I/O devices. Interface One consists of three 25 pin female connectors, on a PC board, to terminate the SMB-2; the ribbon terminates in a 26 pin male connector.







VISIT YOUR AUTHORIZED XITAN DEALER!

Combine the above boards into your main frame or ours and customize a system from the ground up.

Xitan inc.

1101-H State Road/Princeton, New Jersey 08540 □ **(609) 921-0321**

Minneapolis, MN. For further information contact the Society at Box 35317, Minneapolis, MN 55435, Attn: Jean Rice.

Oct 3 Tidewater Computer Club will meet at the Electronic Computer Programming Institute, Janaf Office Bldg., Janaf Shopping Center in Norfolk. The club also meets on the 3rd Tuesday of the month. For details contact: C. Dawson Yeomans, Interface Chairman, 677 Lord Dunmore Dr., Virginia Beach, VA 23462.

Oct 4 Columbus Computer Club will meet at the Center of Science and Industry at 7:30 P.M. For further information write c/o Fred Hatfield K8VDU, Computer Data Systems, 1372 Grandview Ave., Columbus, OH 43212, or call (614) 488-3347.

Oct 4 Kitchener Waterloo Microcomputer Club will meet at the University of Waterloo, Room 3388, Engineering Bldg. #4, University Ave., Waterloo, Ontario, Canada at 7:30 P.M.

Oct 4 Lincoln Computer Club will hold its meeting at the South Branch Library located on 27th and South Sts. at 7 P.M. For more details write Hubert Paulson, Jr., 422 Dale Dr., Lincoln, NE 68510.

Oct 4 New England Computer Society will meet in the cafeteria of the MITRE Corp. at 7:00 P.M. Located on Route 62 in Bedford, MA. Contact Dave Day at P.O. Box 198, Bedford, MA 01730, (603) 434-4239 for details.

Oct 4 The Valley Computer Club will meet at 7 P.M. at the Harvard School located at 3700 Coldwater Canyon, Studio City, CA.

Oct 4 Sacramento TRS-80 User's Group meets on the 1st Wednesday of each month from 7-10 PM. For location and other information call Sal Alestra at (916) 927-0237 or write 437 Berthoud St., Sacramento, CA 95838.

Oct 5 Bay Area Microprocessors Users Group (BAMUG) will meet in the Hayward ROC Center, 26316 Hesperian Blvd., Hayward, CA at 7:30 P.M. For further details write BAMUG, 1211 Santa Clara Avenue, Alameda, CA 94501.

Oct 5 Microcomputer Users Group (MCG) will hold its meeting at the University of Minnesota, Electrical Eng. Rm. 115 at 7 P.M. The club meets every Thursday. For more information write MCG, Dept. of Elec. Eng., 123 Church St. S.E., Minneapolis, MN 55455.

Oct 5 Northwest Computer Society meets in the Pacific Science Center in Seattle, Room 200 at 7:30 P.M. The club also meets on the third Thursday of the month. For more details write NCCN, Box 4193, Seattle, WA 98055.

Oct 6 Crescent City Computer Club will hold its meeting at the University of New Orleans, Lakefront Campus at 8 P.M. Call Bob Latham at (504) 722-6321 for more details.

Oct 6 Microcomputer Information Group will meet at 7 P.M. at the Microcomputer Resource Center, 5150 Anton Dr., Rm. 212, Madison, WI 53719, (608) 274-8925. Len Lindsay, president.

Oct 7 Louisville Area Computer Club (LACE) will meet at the University of Louisville, Speed School Auditorium at 1 P.M. For details, write the club at 115 Edgemont Dr., New Alban, IN 47150.

Oct 7 Milwaukee Area Computer Club will meet at 1 P.M. at the Waukesha County Technical Institute, New Berlin, WI. Call (414) 246-6634 for further details.

Oct 7 Oklahoma Computer Club will be meeting at the Belle Aisle Library at 10 A.M. Call Al Campbell at (405) 842-4933 for details.

Oct 7 South Central Kansas Amateur Computer Association, 9:00 A.M., Wichita Public Library, Wichita, KS. For further information call Chris Borger at (316) 265-1120 or Dave Rawson, 1825 Gary, Wichita, KS 67219, (316) 744-1629 for further details.

Oct 7 Southern Nevada Personal Computing Society will meet at Clark County Community College, Las Vegas, NV at 12:00. The club also meets on the 3rd Saturday of the month. For further information write SNPCS, 1405 Lucille St., Las Vegas, NV 89101 or call (702) 642-0212.

Oct 10 Okaloosa Computer Hobbyist Club will meet in the Community Room of the First Federal Savings & Loan Assoc. of Okaloosa

County, 158 Elgin Pkwy N.E., Ft. Walton Beach, FL at 7 P.M. For details call (904) 242-5938.

Oct 10 Rome Area Computer Enthusiasts (RACE) meets on the second Tuesday of every month at Patty's Stagecoach Inn at 7:30 P.M. For details contact Mike Troutman, RD 1, W. Carter Rd., Rome, NY 13440, (315) 336-0986.

Oct 11 Home Computers Users Group for Radio Shack TRS-80 meets at 7:30 PM. For details write or call TRS-80 Users Group Information of Eastern Massachusetts, c/o Miller, 61 Lake Shore Road, Natick, MA 01760, (617) 653-6136.

Oct 11 Homebrew Computer Club meeting will begin at 7 P.M. in Menlo Park, CA at the Stanford Linear Accelerator Center Auditorium. Contact the club at P.O. Box 626, Mountain View, CA 94042, (415) 967-6754 for details.

Oct 12 The New York Amateur Computer Club meets on the 2nd Thursday of each month at Bernard Baruch College, Rm. 903, 17 Lexington Ave. (corner 23rd St.), New York, NY at 7 PM. For more information write P.O. Box 106, Church St. Station, NY, NY 10007.

Oct 12 Mid America Computer Hobbyist meeting will be at 7:00 P.M. at Commercial Federal Savings & Loan, Bellevue NE. Intersection of Galvin Rd. and U.S. Hwy. 73-75. Write P.O. Box 13303, Omaha, NE 68113 for further information.

Oct 12 North Florida Computer Society will meet at 227 Edison Dr., Pensacola, FL 32505. For details write this address or call Eugene Rhodes at (904) 453-3844.

Oct 12 The Rochester Area Microcomputer Society will meet at the RIT Campus, Rm. 1030, Bldg. 9 at 7:30 P.M. For details write RAMS, P.O. Box D, Rochester, NY 14609.

Oct 12 Utah Computer Association will meet at Murray High School, Rm 154, 5440 S. State St., Salt Lake City, UT at 7 P.M. For details write or call Larry or Holly Barney, 1928 S. 2600 E., Salt Lake City, UT 84108. (801) 485-3476.

Oct 13 HAUCC will meet at 7:30 PM in Rm 117 of the Science & Research Bldg. of the main campus of the Univ. of Houston. For more details write or call P.O. Box 37201, Houston, TX 77036, (713) 661-6806.

Oct 13 Northern New Jersey Amateur Computer Club (NNJACC) will hold its meeting at the Fairleigh Dickenson University, on the Rutherford Campus, Becton Hall, Room B8, at 7 P.M. For details write NNJACC, 593 New York Ave., Lyndhurst, NJ 07071.

Oct 14 The Permian Basin Computer Group — Odessa Chapter meets at 1 P.M. in the Electronic Technology Bldg., Room 203 on the Odessa College campus. For details contact John Rabenaldt, Box 3912, Odessa, TX 79760, (915) 332-911.

Oct 15 Central Florida Computer Club will meet at 2010 Fosgate Dr., Winter Park, FL 32789 2:00 PM. Contact Bill Kerns for details.

Oct 15 Cleveland Digital Group meets at 2 P.M. in the old railroad station at Safier's Inc., 8700 Harvard Ave., Cleveland, OH 44105. Write the club at this address for more information.

Oct 17 Rhode Island Computer Hobbyists (RICH) meets the at the Knight Campus of Rhode Island Junior College in the Faculty Cafeteria at 7:30 P.M. For details contact Emilio Iannucillo, RICH, P.O. Box 559, Bristol, RI 02809, or call (401) 253-5450.

Oct 19 Madison Computer Society will meet at 7:30 P.M. at 2707 McDivitt Rd., Madison, WI 53713. Mike Shoh, president.

Oct 19 Sacramento Pet Workshop meets from 7-10 P.M. every third Thursday of the month. For more information contact David Howe, (916) 445-7926.

Oct 20 Amateur Computer Group of New Jersey (ACGNJ) meets at UCTI, 1776 Raritan Rd., Scotch Plains, NJ 07076 at 7 P.M. For further information write to the club at the above address.

Oct 20 Long Island Computer Association meets at 7 PM at the New York Institute of Technology, Old Westbury Campus, Route 25A between Route 107 and Glen

Cove Rd., Rm. 508. For more details write Long Island Computer Association, 36 Irene Lane East, Plainview, NY 11803.

Oct 21 Computer Hobbyist Group of North Texas will meet at UTA University Hall, Rm 108 at 1 PM in Arlington, TX. For details contact Neil Ferguson at P.O. Box 1344, Grand Prairie, TX 75051, (817) 387-0612.

Oct 21 Philadelphia Area Computer Society will meet at 2 PM at LaSalle College Science Bldg. at the corner of 20th & Olney Ave. For more details write PACS, P.O. Box 1954, Philadelphia, PA 19105.

Oct 21 The 7C's Committee (Affiliated with the Cleveland Digital Group) will meet at Cleveland State University Student Services Bldg., in the Kiva Room at 2:00 P.M. For more information write to Cleveland Digital Group, 8700 Harvard Ave., Cleveland, OH 44105.

Oct 21 San Diego Computer Society will meet at the Grossmont Community College Student Center, 8800 Grossmont College Dr., El Cajon, CA. Doors open at 12:30. For details write P.O. Box 9988, San Diego, CA 92109, or call (714) 565-1738.

Oct 22 Birmingham Microprocessor Group will meet at Southcentral Bell Company headquarters bldg. at 2 P.M. For further details write or call Jim Anderson, 2931 Balmoral Rd., Birmingham, AL 35223; (205) 897-9630.

Oct 22 Summit City Computer Club will meet at the McMillen Library on the Indiana Institute of Technology Campus in Ft. Wayne, IN. For details write the club at P.O. Box 5096, Ft. Wayne, IN 46805.

Oct 24 Computer Amateurs of So. Jersey will holds its meeting at the National Park Municipal Bldg., 7 So. Grove Ave., National Park, NJ at 7:30 P.M. For details call (609) 541-1010, or (609) 541-8296.

Oct 24 Sacramento Microcomputer Users Group, (SMUG), 7:30-9:30 P.M. at SMUD Training Bldg., on 59 St. Write Richard Lerseth, P.O. Box 161513 or call (916) 381-0335 after 5:00 P.M.

Oct 25 Ventura County Computer Society will meet at Camarillo Public Library, 3100 Ponderosa Dr., Port Hueneme, CA 93041 at 7:30 P.M. For more information write: VCCS, P.O. Box 525, Port Hueneme, CA 93041.

Oct 25 Diablo Professional Users Group (DPUG) will meet at Diablo Valley College Library, near the Willow Pass exit of Fwy. 680, from 8-10 PM. For details write or call Bob Hendrickson, Electronics Dept., DVC, Pleasant Hill, CA 94523; (415) 687-8373.

Oct 25 Boston Computer Society will meet at the Commonwealth School, 151 Commonwealth Ave., Boston at 7 P.M. The school is located on the corner of Dartmouth St. in Boston's Back Bay. For information write or call the society at 17 Chestnut St., Boston, MA 02108, (617) 227-1399.

Oct 26 Space Coast Microcomputer Club will meet at 7:30 PM at the Merritt Island Library, Merritt Is., FL. Contact Glynn Mills at R3, Box 904, Merritt Is., FL 32952.

Oct 27 Alamo Computer Enthusiast meets at 7:30 PM in Rm 104 at Chapman Graduate Center at Trinity University, San Antonio, TX. For details call (512) 532-2340, or write to the club at 7517 Jonquill, San Antonio, TX 78233.

Oct 27 Washington Amateur Computer Society will meet at the Catholic University of America, St. Johns Hall, located at Michigan and Harewood Aves. in Washington, D.C. Contact Bill Stewart at (202) 722-0210 for club details between the hours of 10 A.M. and 12 P.M.

Oct 31 The Digital Group Group meets the last Tuesday of each month in the meeting room of Consumer Systems at 2107 Swift Rd., Oak Brook, IL at 7:30 PM. For more information write the group c/o William L. Colsher, 4328 Nutmeg Ln., Apt. 111, Lisle, IL 60532.

 CIRCLE INQUIRY NO. 53

WHITE COLLAR MICROCOMPUTER

By James S. White

Using computers for education is the theme of this month's issue of INTERFACE AGE. Several articles explain some of the techniques and benefits of using computers as teaching tools. Businesses can benefit considerably from these ideas. Education isn't, and shouldn't be, limited to schools.

One of the most important assets of a business is the skills of its people. Education of employees can result in dramatic increases in their skills and performance. Any educational technique which increases the capabilities of employees at reasonable cost is beneficial to the business. For some educational techniques, the rate of return on investment can be very high.

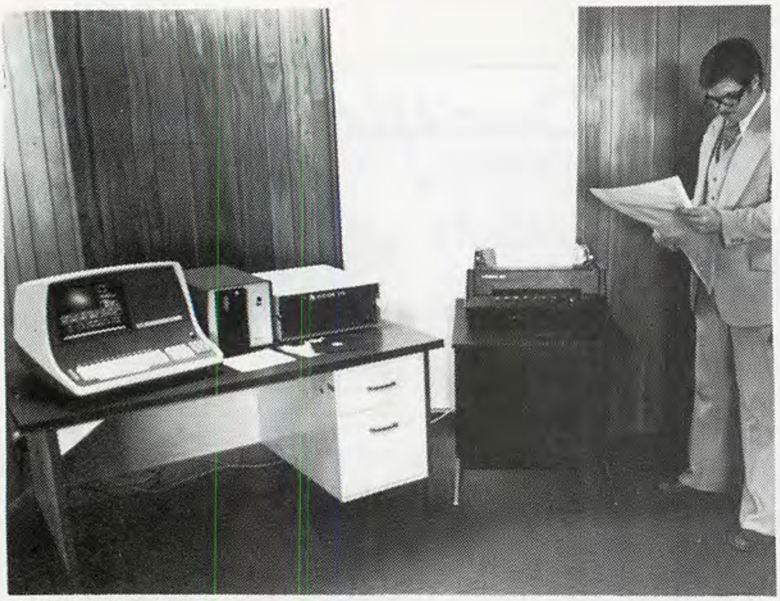
. . .the user receives only the amount of training he or she needs, as well as receiving it just when it is needed. The novice can ask for as much or as little detailed explanation as is needed. . .

Computer assisted education can be done in many ways. Three types of techniques or uses are most obviously beneficial to businesses today.

One ideal use of computers for education is to teach people how to use computers. One possible approach is the historical tutorial method with a new type of teacher, a computer which is the subject as well as the teacher. Under this approach, a student would be "told" by the computer how to use the computer to do a certain job. The computer video terminal or printer would instruct the student step-by-step in what buttons to push, etc. The student's response would be evaluated by the computer program. Subsequent computer instructions to the student could be error explanations, repetition of the lesson with more detail, or instruction on the next phase.

A different approach to computers teaching about themselves is to combine training with doing the job. This prompting is the ultimate in on-the-job education. In this approach, the computer instructs the user step-by-step as the work is done. In more sophisticated versions of such training systems, the user receives only the amount of training he or she needs, as well as receiving it just when it is needed. The novice can ask for as much or as little detailed explanation as is needed for each step or operation. The user who knows the procedures "by heart" is not slowed down by tutorial material.

This tutorial approach is ideal because the student receives practical experience at the same time as training. Skills correctly learned are used and refined as training progresses. And these are exactly the practical skills he or she will need for a job in the practical business environment.



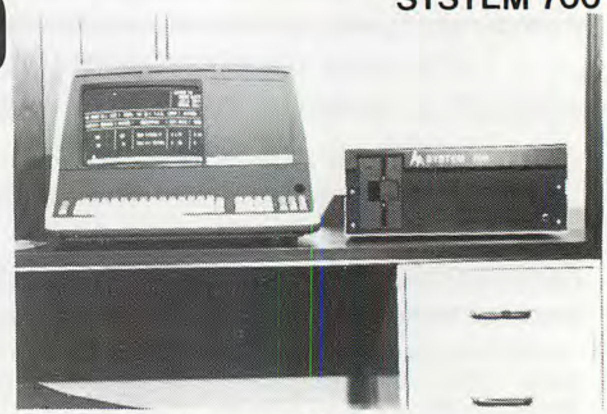
COMPLETE
BUSINESS COMPUTER ACCOUNTING SYSTEMS

WITH FULL PROFESSIONALLY DESIGNED SOFTWARE PACKAGES INCLUDING GENERAL LEDGER, ACCOUNTS RECEIVABLE, ACCOUNTS PAYABLE, POINT-OF-SALE INVENTORY, SORTING, MERGING AND MAIL LIST PROGRAMS. ALL PROGRAMS SHARE A COMMON DISK FILE DATA BASE AND THEREFORE, INSTANT, UP-TO-THE-MINUTE BALANCE SHEETS AND PROFIT/LOSS STATEMENTS ARE NO LONGER A DREAM, BUT ARE NOW REALITY.

SYSTEM 710

DELTA SYSTEMS 700 & 710

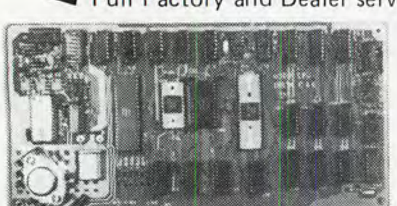
SYSTEM 700



Disappointed by many of the "business" systems you've seen? Nice hardware, but no software, RIGHT? At last there is a totally integrated system (THAT WORKS!) available now which is just right for your needs and budget. Our SYSTEM 700 series of business computers offers completely interactive and self-prompting programs which even your secretary could operate after only 2-3 hours of familiarization.

THE SYSTEM ALSO OFFERS:

- Multi-User Capability (your parts room can run inventory while bookkeeping does general ledger)
- Word Processing (computer generated forms and letters which look individually typed)
- Broad Peripheral Base (6.4 Megabyte floppy disks, 29-70 Megabyte hard disks, Multi-Terminal Adapters, Modems, Controller Interfaces and more)
- Graphics Capability
- User Programmable (Compilers, Assemblers, etc.)
- Extensive Software Library including Cash Flow Analysis, Buy/Lease Analysis, Loan Analysis, Production/Man-hour Ratio Analysis programs, and many more Business/Management aids available at a nominal price.
- Full Factory and Dealer service and maintenance support nationwide.



6800 CPU

- Based on our *FAST* 6800 Central Processing Unit which utilizes the industry standard S-100 mainframe for full compatability with many other S-100 products. (CPU available separately, call for prices)

STARTING AS LOW AS $5999*

*INCLUDING SOFTWARE GL, A/R, A/P, INVENTORY PROGRAM PACKAGE AB-1

DATATRONICS, INC.
SOUTH 2605 SULLIVAN ROAD • 509/926-9938
VERADALE, WASHINGTON 99037
Dealer and Distributor inquiries invited.

See us at
BizComp '78
Booth 3
Atlanta, Ga.
OCT. 27-29

A second possible use of computers in education is as a self-instruction tool — a system where procedures, education, and the tool are totally integrated. Examples might be computer programs to calculate discounted rate of return (net present values), or to obtain certain information from a business's data files.

The user of such a system would need to know nothing about doing these things, only the code for starting the procedure or program. Once he or she had started, the computer would guide him or her through the process, step by step, giving the appropriate amount of detailed instruction or just working with the user to do the job.

Many types of business applications could be supported by systems of this type. All processes where computer and people work together to accomplish a goal are appropriate for consideration.

Perhaps. . .computer assisted education. . .will make practical for businesses the building of employee skills. . . One benefit of this educational capability might be the businesses's opportunity to select employees for highly desirable but less easily created skills.

Such systems might eliminate the publishing of procedures for many organizational processes. Having the procedures in just one place, the computer, eliminates the too-frequent problem of someone not receiving an updated procedure or of continuing to use an obsoleted version. Even keeping the procedure up-to-date, and exactly what the organization wants, may be more practical when it is stored in the computer rather than being published. Different versions may even be practical — a group of formal procedures which responds to different people or groups in various ways, as determined by management. One example might be the computer's using different interest rates in calculations, reflecting management's varying expectations of various departments' performance.

Computerized procedures can be relatively easy to learn. Their efficiency is increased because only those who are sure to use a procedure learn it just when they need it, so there is no over-training to compensate for forgetting. And the virtual elimination of errors in procedure use further increases efficiency.

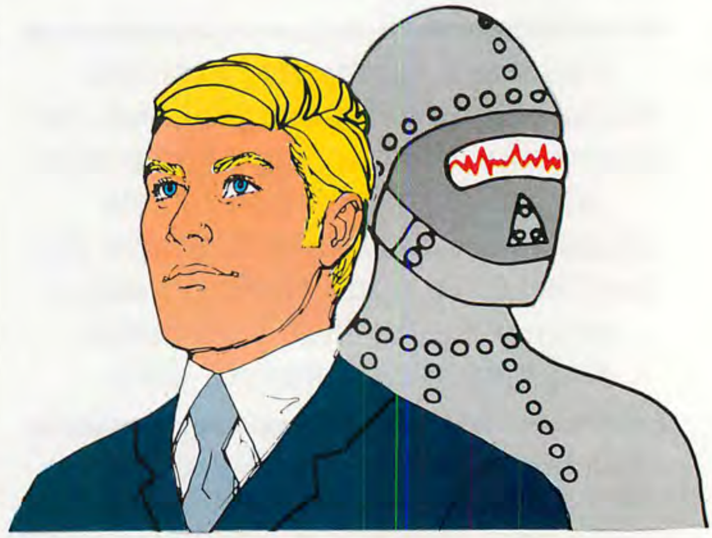
A third possible use of computers is for general or applied skills education. Teaching of skills is the basic objective of education and an historical use of computers. Traditionally, businesses have done little teaching of skills. Instead, they have tried to hire skilled people and have settled for the best combination of skills and other characteristics available when they had an opening.

This historical approach has clearly been less than ideal. Perhaps the new computer-assisted education technology will make practical for businesses the building of employee skills in needed areas. One benefit of this educational capability might be the business's opportunity to select employees for highly desirable but less easily created skills.

The preceding are only a few of the ways that computerized educational technology can benefit businesses. Computer users who consider such possibilities when designing systems or evaluating opportunities will probably find more.☐

THE MIND REVOLUTION

By Merl Miller



People have always been fascinated by the possibility of a nonhuman creature displaying human capabilities. At the same time, there has been the fear that we could discover a creature whose intelligence is greater than ours. Our earliest literature tells stories of gnomes, elves and genies — all of which possess some human traits. This superstitious fear has been transferred to machines like Hal 2000 or the Forbian Project.

Robots (and computers) have generally been portrayed in fiction as dangerous beings that need careful monitoring. With the advent of personal robots, this might be true. Consider the following:

> The lady of the house is out. The family robot is at home vacuuming. Suddenly, there is a knock on the door. The robot turns off the vacuum cleaner and says, "Excuse me; who is that?"
>
> A man's voice replies, "It's the plumber. I've come to fix the sink."
>
> Unfortunately, at this moment the robot's voice control program goes into a do-loop and it can only reply, "Excuse me; who is that?"
>
> "It's the plumber. I've come to fix the sink!" the plumber says, emphatically.
>
> "Excuse me; who is that?" replies the robot.
>
> Pounding on the door, the plumber shouts at the top of his voice, "It's the plumber. I've come to fix the sink!!!"
>
> "Excuse me; who is that?" replies the robot.
>
> Screaming, crying and pounding on the door, the plumber yells, "IT'S THE PLUMBER. I'VE COME TO FIX THe s-s-i. . ." At this point, he has a heart attack and dies. The robot, hearing no more noise, goes back to the vacuuming. When it begins another activity, it falls out of the do-loop.

When the lady of the house returns, she finds the plumber in front of the door. She exclaims, "Who is that and what is he doing here?!?!?"

The robot turns off the vacuum cleaner and replies, "It's the plumber. He's come to fix the sink." Buzz-z-z, whirr-r-r-r, humm-m-m.

Oh, well. How far are we from having household robots? Probably no more than a few years. Public acceptance of such a machine is on the rise, so who knows? If you found one on your doorstep, what would you do?

A more appropriate question might be, "What would the robot do if you took it in?" It would probably amuse you and run up your electric bill — not much else. There are some interesting robots around, but a totally self-sufficient model has not yet been built. A brief history of thinking machines will show us that this achievement is not far off.

In the early 1950's, W.G. Walter built the first turtle. It was a mechanical device shaped something like an elongated army helmet with aerials. The turtle proved that an electronic machine could exhibit behavior similar to an insect or simple animal.

No serious study of robots should be undertaken without studying a little history, beginning with the first thinking machine. It was designed and built by British cynerneticist and mathematician Ross Ashby in 1940. The Homeostat, as it was called, was a box that contained a series of rotary switches and indicator dials. The switches were used to vary voltage inputs to the circuits. You could then read the voltage at other selected points in the circuit by looking at the dials.

The most interesting thing about this device was that it seemed to exhibit an intelligence of its own. No matter what arbitrary new positions the switches were turned to, the needles on the dials always returned to their original position. The only exception to this was that if a large group of switches were changed at the same time, the needles would flutter around for a while and then settle into a new position that would be maintained.

Dr. Ashby compared the performance of the Homeostat to that of a lazy dog trying to take a nap. If flies bother him, the dog will shake his head or tail, might even move a little, but returns to his original position. If you step on his tail, the dog moves to another position and goes back to sleep. The Homeostat demonstrated that an electronic "being" could exhibit this same type of single-mindedness.

In the early 1950's, W.G. Walter built the first turtle. It was a mechanical device shaped something like an elongated army helmet with aerials. The turtle could roll about and move toward the light. If the light was too bright, it would make a hasty retreat. When no light was available, it would wander around as if lost, apparently searching for "something". The turtle proved that an electronic machine could exhibit behavior similar to an insect or simple animal.

As robot history unfolded, one step every decade, the next significant accomplishment did not come until the early 1960's. The Hopkins Beast, built by a group at

SELECTRA-TERM™

Turn your TRS-80 into a complete word processing system.

Just hook up the cables and connectors supplied with your SELECTRA-TERM and you're ready to run. Input your text and type the single command: LPRINT. The SELECTRA-TERM automatically outputs clear, clean high fidelity copy.

Incredibly simple!

```
COMPARE THIS
DOT MATRIX OUTPUT
```

```
with the
SELECTRA-TERM high
fidelity impact
print!
```

Brand new. $1925☆
Fully assembled and tested.
Delivery five weeks.
Many options available.

☆115 VAC, 60 Hz Model.

SELECTRA-TERM can also be connected to the parallel port of PET ▪ Apple II ▪ Heath H8 ▪ IMSAI ▪ Cromemco ▪ Alpha Microsystems ▪ Space Byte ▪ North Star Horizon ▪ SWTP ▪ Vector Graphic ▪ Sol ▪ Polymorphic ▪ Digital Group ▪ Ohio Scientific ▪ Altair ▪ Sorcerer ▪ Xitan ▪ Iasis ▪ KIM ▪ Versatile CRT ▪ EXORciser

Direct international sales inquiries to
International Sales Division
17648 Orna Drive
Granada Hills, CA 91344 USA

micro computer devices inc.
960 E. Orangethorpe, Bldg. F
Anaheim, California 92801
Telephone (714) 992-2270

Discounts Available to
EDUCATIONAL ACCOUNTS
Contact Dolores Sun
P. O. Box 8394 • Ann Arbor, MI 48105
(313) 665-8514

**TRS-80 is a product of Radio Shack*

"Innovators to the Microcomputer Industry"

CIRCLE INQUIRY NO. 27

Johns Hopkins University, was the first machine to demonstrate a survival instinct. The Beast's one purpose in "life" was to keep its batteries charged (fed). The basic thrust of the research was to build a self-contained machine small enough to move around on its own. The Beast was about three feet tall and resembled a mobile, inverted garbage can with rails on top.

The Beast found its way around with sonar as it tried to stay between two walls. Knowing its distance from a wall, the Beast would keep its eye focused on the wall, looking for something "edible". Just like a simple biological being, the Beast separated the world into two categories: edible and non-edible. To the Beast, "edible" meant an electric outlet. Its eye and logic governing the eye were designed for one thing: to recognize "food". If it saw a delicious electrical outlet, it would head for it with due haste. It would stick out its plug-shaped tongue and have "lunch". For the Beast, this meant that if it is on the wall, about twelve inches above ground, darker than its surroundings, rectangular in shape with a width about one and one-half times its height, eat it.

. . .the first machine to demonstrate a survival instinct. The Beast's one purpose in "life" was to keep its batteries charged (fed). The basic thrust of the research was to build a self-contained machine small enough to move around on its own. The Beast was about three feet tall and resembled a mobile. . .garbage can. . .

An updated version of the Beast is being developed in the Duane Physical Laboratory at the University of Colorado. Newt, as it is called, is being built by a group of amateurs in a privately funded project. The objectives of the robot are:

> It must be able to explore the environment in some orderly manner, measure the attributes of objects and obstacles encountered, classify them according to some scheme, and incorporate them in its evolving internal world model. The world model must have a logical structure which allows modifications to be easily made; it must be compact with respect to memory space, and it must use a design which can be consulted in some reasonable way. The robot must be able to manipulate the world model (cognition), derive informed decisions from it, and carry out these decisions in physical action to achieve broadly defined goals.*

Robot building and the whole field of artificial intelligence is wide open to amateurs. There is no doubt that you can do some interesting work in this field and build your own robot. No one knows what the limits are. You can only find out by trying. □

*Ralph Hollis, "NEWT: A Mobile Cognitive Robot," *Byte*, June 1977, pp. 30-45.

CIRCLE INQUIRY NO. 9

JURISPRUDENT COMPUTERIST

By Elliott MacLennan
Attorney-at-Law
Stephen Murtha

BUSINESS PLANS

Last month's column was the first of two dealing with the topic of business plans. This month's column will be the conclusion of that series.

R & D programs and expansion: One of the common errors made in the microcomputer industry is the lack of time and money committed to R & D and future product expansion. Too often, once the business is started, the entrepreneur becomes chief order-taker, parts expeditor, and paper shuffler because the business is undercapitalized and cannot hire someone to do the job. As a result, the next generation of products never gets into production, and the company stagnates or goes belly up 6 to 18 months after its formation. New products do not just happen, they are planned and developed. The company which does not continually update their product line in an industry which experiences the rapid technological change typical of the microcomputer industry is asking for trouble. While the time and money involved in an adequate R & D program often seems prohibitive, they far outweigh the costs of not having a program.

Pro forma financial statements: Pro forma financial statements are projected financial statements based on a series of assumptions about future operations. Typically, three statements are drawn up: the income statement, the balance sheet, and the cash flow statement. These three statements will give a pretty clear picture of how profitable the business will be and how soon it will be profitable if the assumptions used about sales, costs, etc. prove correct. One common mistake made is to draw these statements up first, and then make enough rationalizations about sales, etc. to make the projections fit these statements. Instead, the assumptions should be objectively made, and then the statements should be prepared. If it is done this way and the statements do not show favorable results, in most probability the business will not work.

Of these statements, probably the most attention should be focused on the cash flow statement, as this is the area where most young and expanding businesses have trouble. Often a business can show a profit, but if a fair amount of the sales are on credit, the business may not have the cash to pay its own creditors. This shortage of cash, or working capital as it is sometimes called, will show up in the cash flow statement. Any deficit amount represents additional capital which must be obtained if the business is going to grow and prosper.

Capital sources: This section should basically spell out the amount of capital the new business needs and where that capital is going to come from. In addition to

the start-up capital required, mention should be made of capital needs as the business grows and expands. The total amount of capital required should be spelled out, as well as how much equity and how much debt should be required. If any of the investors are not part of the management team, any non-monetary contributions which they may be called upon to make should be spelled out.

Legal structure: This section is closely related to the previous section since one of the considerations which goes into the legal structure is the capital requirements of the business and the investment and tax requirements of the investors. In addition to specifying whether the business will be a sole proprietorship, partnership, Sub S corporation, Sub C corporation, or some other form, any additional agreements such as a buy-sell agreement, etc. should be discussed. The subjects of raising capital and the tax and legal aspects of choosing a business form have been covered in detail in previous columns. Rather than be redundant, we refer the reader to back issues of INTERFACE AGE and suggest these columns be re-read.

Professional advisors: This section should list the attorney, accountant, banker, insurance broker, advertising firm, and any other outside sources of professional advice which the business will call on. Our next column will deal more in depth with how to select these advisors, and what they can do for a business.

As you can see from the previous discussion, the formulation of a complete and thorough business plan is no small undertaking. When properly done, it is essentially taking the business through the first year or two on a dry run. When dealing with something as uncertain as a new business, it is of course impossible to anticipate all of the possible problems which could arise. However, by solving the foreseeable problems before they actually arise, more time and energy will be available to the entrepreneur to solve those unexpected problems which are an integral part of the business environment.

Despite the valuable contribution a business plan can make to the managers of a business, the vast majority of business plans are prepared for the investment community. A word of caution is in order at this point. When used to attract investors for a business, a business plan is usually referred to as a prospectus. Both state and federal laws regulate the solicitation of investors outside of the business. Check with your attorney to make sure that any material presented to a potential investor satisfies all legal requirements as there are penalties for illegal offerings.

Some of the information needed to put together a business plan may not be readily available to the entrepreneur. Fortunately, there are a number of sources of information which can be of great value. The SBA puts out a series of publications dealing with various aspects of the operation of a small business. Various banks also have their own publications dealing with small business management. Finally, public libraries and universities will have books available dealing with every business topic from accounting to marketing. Familiarizing yourself with these resources can be of tremendous help in preparing your business plan. □

The material presented in this column is intended for the reader's general information. The authors request that the reader consult professional advisors prior to applying this material to his or her specific situation. Anyone needing further information can contact the authors directly at:

Elliott MacLennan, 2855 Mitchell Dr., Suite 130 Walnut Creek, CA 94598

Stephen Murtha, 3 Altarinda Dr., Suite 304 Orinda, CA 94563

Membership Application

IEEE COMPUTER SOCIETY

Please send me my free copy of (number in order of preference–quantities are limited):
☐ (065) *Proceedings, 1976 Conf. on Micro &Mini Systems;* ☐ (077) *COMPCON 74 Fall Digest, Micros & Minis-Application & Design;* ☐ (067) *COMPCON 75 Spring, Computer Technology to Reach the People;* ☐ (035) *Proceedings, 3rd Texas Conf. on Computing Systems;* ☐ (104) *Proceedings, 2nd International Conf. on Software Engineering.*

MAILING ADDRESS

First name ____ Middle initial(s) ____ Last name ____

Street address ____

City ____ State/Country ____ Zip ____

Full signature ____ Date ____

OCCUPATION

Title or position ____

Firm name ____

Firm address ____ Street ____

City ____ State/Country ____ Zip ____

IEEE membership no. or affiliate society membership no. (if applicable) ____ Grade ____

EDUCATION (highest level completed)

Name of educational institution ____

Course ____ Degree received ____ Date ____

Date of birth ____ Male ☐ Female ☐

ENDORSEMENT (Name one individual, preferably an IEEE member, who knows you professionally.)

Name (print in full) ____

Street address ____

City ____ State ____ Zip ____

FOR OFFICE USE ONLY

Member No.	St./Cntry.	Zip Code/City	Reg.	CN	Sect.	Subsec.
3 – 10	11	14	20	22	24	26

C/S	County	A/C	BPA CODE	Grade	Birthdate Mo.	Birthdate Day	Birthdate Yr.	Sex	Election Date Mo.	Election Date Year
28	29	32	33	39 40	42			48	72	75

If you are:	your rates* will be: FULL YEAR (9/1/78 to 2/28/79)*	HALF YEAR (3/1/79 to 8/31/79)*
• an IEEE member who wishes to join the Computer Society	☐ $ 8.00	☐ $ 4.00
• an individual who wishes to join both the IEEE and the Computer Society**	☐ $63.00	☐ $36.50
• an individual joining the Computer Society as an affiliate member ***	☐ $28.00	☐ $14.00

PUBLICATION OPTIONS

If, in addition to your automatic subscription to COMPUTER Magazine, you would also like to receive: add: *

• Transactions on Computers (1161)	☐ $6.00	☐ $3.00
• Transactions on Software Engineering (1171)	☐ $6.00	☐ $3.00
• Transactions on Pattern Analysis & Machine Intelligence (1351)	☐ $4.00	☐ $2.00
• Journal of Solid State Circuits (4101)	☐ $6.00	☐ $3.00
• Journal of Oceanic Engineering (4201)	☐ $4.00	☐ $2.00
• Proceedings of the IEEE (5011) (not available to affiliate members)	☐ $10.00	☐ $5.00

* Observe half-year & full-year rates during enrollment periods indicated.

** If you join both IEEE and the Computer Society, you are entitled to all IEEE benefits, including automatic subscription to SPECTRUM. Rates shown reflect $10 IEEE entrance fee (one-time assessment) for all regions. Rates also reflect $10 per year regional assessment for Regions 1-6 (continental U.S.). There is a $7 per year regional assessment for Region 7 (Canada). Members in Region 8 (Western Europe & Mid-East), 9 (Latin America), & 10 (Far East) deduct $5 from half-year rates, $10 from full-year rates. Members in Region 7 deduct $1.50 from half-year rates, $3 from full-year rates. ACM members deduct $2.50 from half-year rates, $5 from full-year rates.

*** ACM discount does not apply to affiliate membership, which is already discounted.

Hardcopy bulk air option for members in Regions 8-10 (Western Europe, Latin America, & the Far East)

Add the following amount(s) for 1-week delivery for **Computer,** 2 to 6 week delivery for **Transactions.**

	Western Europe Full year	Western Europe Half year	All Other Areas Full year	All Other Areas Half year
Computer	☐ $15.00	☐ $7.50	☐ $43.00	☐ $21.50
Transactions on Computers	☐ $ 8.50	☐ $4.25	☐ $35.00	☐ $17.50
Journal of Solid-State Circuits	☐ $ 5.00	☐ $2.50	☐ $20.50	☐ $10.25
Transactions on Software Engineering	☐ $ 4.00	☐ $2.00	☐ $16.00	☐ $ 8.00
Transactions on Pattern Analysis & Machine Intelligence	☐ $ 3.00	☐ $1.50	☐ $11.00	☐ $ 5.50
Journal of Oceanic Engineering	☐ $ 2.50	☐ $1.25	☐ $10.50	☐ $ 5.25
Proceedings of the IEEE	☐ $13.00	☐ $6.50	☐ $52.00	☐ $26.00

"Western Europe" includes Albania, Austria, Belgium, Bulgaria, Cyprus, Czechoslavakia, Denmark, Finland, France, East Germany, West Germany, Gibraltar, Greece, Greenland, Holland, Hungary, Iceland, Ireland, Italy, Lichtenstein, Luxembourg, Malta, Monaco, Norway, Poland, Portugal (and Azores), Rumania, Spain (and Canary Islands), Sweden, Switzerland, Turkey, United Kingdom, USSR, Yugoslavia. "All other areas" includes all other countries outside the US & Canada.

Use the numbers to identify your plant activity and your own work. If more than one activity is involved, use the code number for the most prevalent. Note: if you select "other" for work and plant code or "other personnel" for job function code, be sure to explain on the lines provided.

WORK AND PLANT (Enter codes)
Plant ____ Your own work ____

1. Large computers
2. Minicomputers
3. Microcomputers
4. Computer peripheral equipment
5. Data processing systems (system integration)
6. Office and business machines
7. Test, measurement, and instrumentation equipment
8. Communications systems and equipment
9. Navigation and guidance systems and equipment
10. Consumer entertainment electronic equipment
11. Consumer electronic appliances
12. Other consumer electronics
13. Industrial controls, systems, and equipment
14. Components and subassemblies
15. Materials and hardware
16. Aircraft, missiles, space and ground support equipment
17. Oceanography and support equipment
18. Medical electronics
19. Industrial companies within OEM incorporating electronics equipment in their end product, not elsewhere classified
20. Independent research, test, and design laboratory and consultant (only if you are not connected with a manufacturing company)
21. Government agency and military
22. Industrial companies using and/or incorporating any electronic products in their manufacturing, research, or development activities
23. Communication (radio, TV, police)
24. Transportation services (airline, railroads, etc.)
25. Computer and data processing services: service bureaus, software services, timesharing, consulting
26. All other commercial users
27. Power generation equipment manufacturer
28. Power production (atomic, electrical, etc.)
29. Power generation
30. Power transmission
31. Power distribution
32. Utilities, except power (telephone, telegraph, pipelines, etc.)
33. Distributor
34. School, university, or library
35. Others (explain)

JOB FUNCTIONS (Enter code) ____

1. General and corporate management
2. Design and development engineering (circuits, components, equipment systems)
3. Engineering services (evaluation, quality control, reliability standards, test)
4. Basic research
5. Manufacturing and production
6. Engineering support (draftsman, lab assistant, technician)
7. Purchasing and procurement
8. Marketing, including sales
9. Computer systems operations
10. Engineering systems planning and design (utilities)
11. Operations including construction & maintenance (utilities)
12. Dean, professor, instructor, etc.
13. Student
14. Other personnel (explain)

JOB CATEGORY (Enter code) ____

1. Management
2. Engineering

Mail the completed application and full remittance (check payable to IEEE) to: IEEE Computer Society, 5855 Naples Plaza, Long Beach, CA 90803

FROM THE FOUNTAINHEAD

By Adam Osborne

I have just returned from visits to Britain and Switzerland. While in these two countries, I attended a number of shows and talked to various people in the **European microcomputer industry.**

I noted a significant increase in the use of microprocessors throughout Europe as compared to last year. But INTERFACE AGE readers will probably be most interested in the fact that Europe represents a far more attractive market for microprocessor consultants than does the U.S.A.

Let us explore the reasons for this rather surprising situation.

In the U.S.A., the customer base for microprocessor consultants is generally limited to relatively small companies. Large companies tend to be self-sufficient, relying on their own employees for the bulk of their microprocessor expertise and using consultants only under special circumstances. This results from the lack of consultants when large U.S. companies first started using microprocessors; indeed, many of today's consultants are ex-employees of these early microprocessor users.

In contrast, most European microprocessor users, both large and small, are looking at microprocessors for the first time. These companies are certainly not going to take the time and spend the money to build in-house expertise (as their U.S. cousins were forced to do) when knowledgeable consultants are readily available. And if the mini/mainframe computer pattern is followed, these companies will keep on using consultants for a long time to come. In the future, therefore, different patterns are likely to develop, with a wide variety of large and small companies using consultants in Europe while a limited number of small companies use consultants in the U.S.A. Clearly this makes Europe a far more interesting market for microprocessor consultants. In particular, large consulting companies can survive in Europe, serving the needs of large customers. Large consulting companies will not survive in the U.S.A.

Consequently, the prospects for any new consulting company forming in the European market look good.

There are still very few computer stores in Europe, and the few there look like small systems houses. For example, only a minority of computer stores actually have a store front, and their customer base is heavily industrial. Even small business systems are selling unevenly. Some stores report excellent sales of business systems, while others say their customers are too conservative to buy a business computer from a store. Here again, Europe offers a significant opportunity for anyone who has a solid background in small business computer systems. I am sure that small business systems will sell well in Europe, just as they are beginning to sell well in the U.S.A.

Some interesting European magazines and hardware products are beginning to appear. In Switzerland, for example, Ludwig Drapalik publishes *Micomp,* the first German language microcomputer magazine. *Micomp* already has a circulation of more than 15,000 and is growing rapidly. In London I saw the first issue of *Practical Computing* at the On-Line Computer Fair. *Practical Computing* expects to quickly achieve a circulation in excess of 30,000.

While in Geneva, I was intrigued by the wide variety of hardware products available from Stoppani Electronic Company. They sell the "Dolphin" system, which can be configured to run with many different microprocessors. It is interesting to look at microprocessor popularity, as seen by Stoppani Electronic. They list microprocessors by popularity as follows:

1. Zilog Z80
2. Signetics 2650
3. Motorola 6802
4. Intel 8085
5. Texas Instruments TMS 9980

Stoppani Electronic can be contacted at:

CH-3000
Bern 21
Konizstrasse 29
Switzerland

A subset of Cobol has been developed for microprocessors by two companies in Europe. They are:

Microfocus Limited
18 Vernon Yard
Portobello Road
London W11 2DX

CAP-CPP, Inc.
299 California Street
Palo Alto, CA 94302
(415) 326-1379

In the U.S.A. we are finally beginning to see some working microcomputer business systems. We are passing from the days of promise to the days of product.

California Microcomputer Company (166 East 4th Avenue, Chico, California 95926) sent me an excellent set of documentation for their **accounting system.** This system includes: Payroll, Accounts Payable, Accounts Receivable, and General Ledger. The system has been written in 8080A assembly language using the CP/M operating system. I have spoken to a few users of this system; they are enthusiastic about

its capabilities, but unfortunately none have had the system for more than a few weeks. But then, that is true of almost any microcomputer-based business system on the market today. We are still at a time when only those with the pioneering spirit should buy.

An interesting idea comes from Ron Jeffries. Ron is offering a **cassette based magazine for PET owners.** I am intrigued by the possibilities in Ron's idea, and shall follow his progress closely. Anyone who has a Commodore PET should at least give Ron a chance by subscribing to his cassette magazine. Ron's phone number is (805) 967-0905.

On several occasions I have discussed the **AMD9511 Arithmetic Professor,** which, according to its specifications, must be the answer to many a microcomputer user's dreams. For those of you with number-crunching applications, here is a single chip that will quickly calculate transcendental functions. Unfortunately, the AMD9511 in its first version has a number of "features". (I define a feature as a design error which engineering could not get in time and so gave to marketing to dress up.) The AMD9511 does not reset properly, and some of its answers are not very accurate. I suggest we all wait for the 9511A.

Don Lancaster sent me a copy of his new book, **The Cheap Video Cook Book.** Don has produced a remarkable book that we should all study carefully. It describes how you can interface black and white or color television to your microcomputer system using very few low-cost devices. But that is not why you should get the book. The true value of this book lies in the way it goes about demystifying hardware. Too many microcomputer users fall into the trap of running away from hardware. They are content to write programs, but heaven forbid that they should ever wire-wrap a chip; and if their hardware fails, they scream for a service man. This is all very unnecessary. Learning to work with hardware is just as simple as learning assembly language programming — a point which Don Lancaster's book makes very clear.

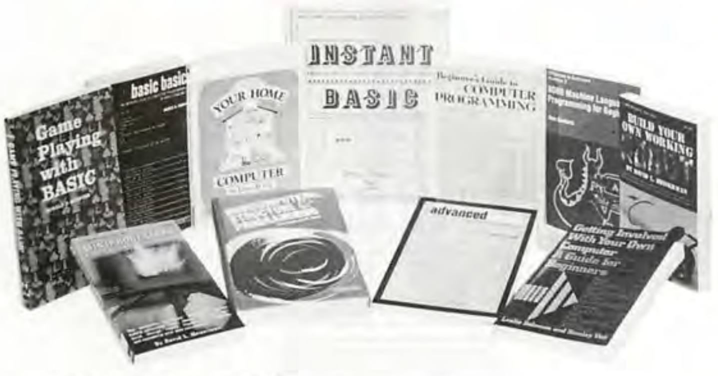
I received an interesting letter from Alan Ashley, who has created some development software for the Z80 microprocessor. Alan sells his development software for $75.00 or $99.00, depending on versions. Alan may be reached at (213) 793-5748. I know nothing about Alan Ashley's software since he sent me no descriptive material; his purpose in writing was to discuss the problems faced by people entering the market with new hardware or software products. How is someone with **a new product and a limited budget** going to sell anything? Since this is a question that many readers will probably ask, let me give a general answer:

1. You can come up with the product when no one else has it and everybody wants it.
2. You can spend a lot of money promoting it.

Most of the popular microcomputer hardware and software on the market today (plus the popular books and magazines) fall into the first category. They appeared on the market when everybody wanted them and nothing else was available. Now they are established, and no one else can expect the same quick and inexpensive success.

My answer to Alan Ashley and other people like him is discouraging. If you come up with a new product, even though it is better than the existing competition, you had better have a very large advertising and promotional budget, or you will be doomed to obscurity. If you do not have the money for a large advertising and promotion budget, choose a product where there is no competition.☐

PUZZLED ABOUT COMPUTERS?

Data Dynamics Technology has a library of answers. . .

Game Playing with BASIC
By Donald D. Spencer. 166 pages, $6.95
Order No. HAY5109-3, paper

Basic BASIC: An Introduction to Computer Programming in BASIC Language - 2nd Edition
By James S. Coan. 288 pages, $8.95
Order No. HAY5106-9, paper

Your Home Computer
By James White. 200 pages, $6.00
Order No. DMX05-1, paper

Instant BASIC
By Jerald R. Brown. 180 pages, $6.00
Order No. DMX04-3, paper

Computer Programming
By Brice Ward. 309 pages, $7.95
Order No. TB574, paper

8080 Machine Language Programming for Beginners
By Ron Santore. 104 pages, $6.95
Order No. DP14-2, paper.

Build Your Own Working Robot
By David L. Heiserman. 234 pages, $5.95
Order No. TB841, paper

Miniprocessors: From Calculators to Computers
By David L. Heiserman. 195 pages, $5.95
Order No. TB971, paper

Minicomputers: Structure and Programming
By T.G. Lewis and J.W. Doerr. 282 pages, $13.95
Order No. HAY5642-7, cloth.

Advanced BASIC
By James S. Coan. 192 pages, $7.95
Order No. HAY5855-1, paper.

Getting Involved with Your *Own* Computer: A Guide for Beginners
By Leslie Solomon and Stanley Veit
216 pages, $5.95
Order No. RID004-8, paper

Microcomputers At A Glance
By Donald D. Spencer. 192 pages, $7.95
Order No. CAM021-8, paper

An Introduction to Microcomputers: Volume 1, Basic Concepts
By Adam Osborne. 282 pages, $8.50
Order No. OSB2001, paper.

An Introduction to Microcomputers: Volume 2, Some Real Products
By Adam Osborne. 868 pages, $15.00
Order No. OSB3001A, paper

An Introduction to Microcomputers: Volume 0, The Beginner's Book
By Adam Osborne. 226 pages, $7.95
Order No. OSB6001, paper

Accent on BASIC
By Donald D. Spencer. 104 pages, $5.95
Order No. CAM003-X, paper.

How to Plan and Install Electronic Burglar Alarms
By Howard Bierman. 120 pages, $4.95
Order No. HAY5734-2, paper

The BASIC Workbook
By Kenneth E. Schoman, Jr. 120 pages, $4.25
Order No. HAY5104-2, paper

A Quick Look At BASIC
By Donald D. Spencer. 64 pages, $4.95
Order No. CAM015-3, paper

. . .And More!

INTERFACE AGE Binders and Slip Cases

Data Dynamics Technology is now offering deluxe binders and slip cases which will place each back issue of INTERFACE AGE at your fingertips. Each binder and slip case is constructed of a handsome blue vinyl with INTERFACE AGE stamped in gold foil on the front cover and spine. These rugged binders and slip cases can hold 12 issues each and will protect your back issues of INTERFACE AGE for years.

TYCHON's 8080 Octal and Hex Code Cards

The code cards are a sliderule-like aid for programming and debugging 8080 software. Both cards contain all the standard mnemonics and either their corresponding octal or hex codes. The pocket size cards are 6.5 by 3 inches (16 by 8 cm) with color-coded instructions to provide a neat, logical format for quick reference. The back of both cards is printed with an ASCII code chart for all 128 characters plus the 8080's status word and register pair codes.

9/78

DATA DYNAMICS TECHNOLOGY P.O. Box 1217, Cerritos, CA 90701

Name(Print) ______________________

Address ______________________

City ______________________ State ________ Zip ________

Please send me:

Description	Qty	Price	Total	Book Order #	Qty	Price	Total
Binders		7.50					
Slip Cases		5.95					
Hex Code Cards		2.95					
Octal Code Cards		2.95					

Shipping & Handling Charges
Binders and Slip Cases $1.50 ea. U.S., $2.00 ea. Foreign
Code Cards $ .50 ea. U.S., $ .75 ea. Foreign
Books $ .75 ea. U.S., $1.50 ea. Foreign

TOTAL ORDER $ ________
***TAX $** ________
SHIPPING & HANDLING $ ________
TOTAL ENCLOSED $ ________

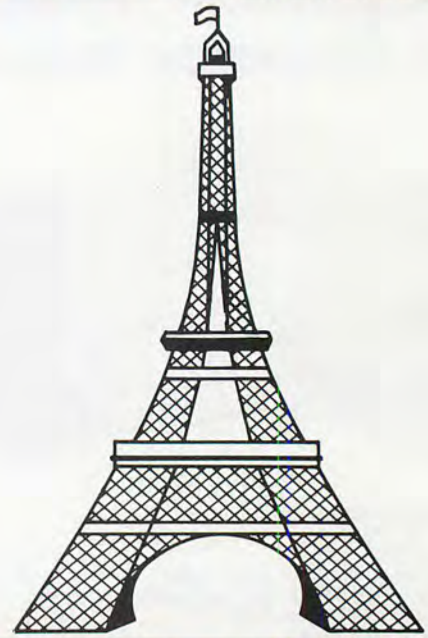
☐ Visa # ________ ☐ M/C # ________ ☐ Check or M.O.(U.S. Funds drawn on U.S. bank)

Exp. Date ________ Signature ______________________

*California residents add 6% sales tax. Availability and prices quoted subject to change without notice.
Please allow six weeks for delivery. You may photocopy this page if you wish to keep your INTERFACE AGE intact.
Orders *cannot* be shipped unless accompanied by payment, including shipping & handling and tax where applicable.

DATA DYNAMICS TECHNOLOGY, A Division of INTERFACE AGE Magazine (213) 926-9544

EUROPEAN



INTERFACE

By Hans Drewitz and Roland Hesse

NCC-SPAETLESE

The most interesting aspect of this year's NCC (National Computer Convention) for Europeans was the consideration of the direction in which the computer industry is going. In particular, this show was expected to answer some questions concerning the near future of mini's and micro's.

Can we expect prices for a small microcomputer system to be dramatically lower than today's prices? To what extent will manufacturers integrate their systems? What is the role software is going to play for small business computing and personal computing?

Here is how I read the signs of NCC 1978.

The peripheral industry is getting ready for the low price computer market. CII-Honeywell-Bull's 10 MB disk is an excellent example of fast product development for the mass computer market. A disk drive in true table top dimensions with a non-aggressive head/surface technology is badly needed in the market.

Floppy disk technology is well underway to occupy the field between 1 and 10 MB on-line storage. More capacity for the same price will be the name of the game in this area.

What we can expect in the near future is more and more powerful small computer systems in the price range of $5,000 and $10,000 but not dramatically lower prices in the near future.

Undoubtedly there is a trend to physical integration for small computers. Technological progress and the temptation to be able to lock a customer into a particular product line are supporting this trend strongly.

As a consequence, software, specifically systems software like languages and access methods, are beginning to play a dominating role. Soon software considerations will make the buying decision for microcomputer systems, and all the hardware questions will be left to the system integrator.

One of the purposes of this column is to inform our European readers about the microcomputer industry in the U.S. from a European point of view. Therefore, we will occasionally report on positive examples of companies in the field based upon actual business experience with them in Europe.

The process of sorting out the good companies from the weak ones is well underway, and some of the familiar names might not be with us in 1980.

I visited several of the companies, spoke to their management, looked at their offices, talked to the staff, and I would like to report on two of the more successful companies in the S-100 bus computer field.

First, Industrial Micro Systems. Fifteen months ago one could see a great variety of memory boards in a Computer Fair. Companies were charging whatever they could get from the inexperienced and confused buyer. IMS changed this market drastically with excellent boards and competitive prices. Delivery is usually on schedule and the response in special situations is fast and cooperative.

IMS does a professional job in all areas. The management is experienced, has quickly learned to deal with European buyers, and understands the special problems involved. Secretaries and staff are friendly and efficient. It's a pleasure to do business with this company.

The other example is Processor Technology. Since 1976, I have watched this company growing with interest. Until recently, their management did not seem to be interested in doing business in Europe. This strategy is debatable. However, the quality approach of this company is remarkable.

If you buy a SOL assembled and tested, it has really been tested. Maybe some of you still believe this is a standard procedure in this industry. Everything I have seen so far tells me this is the exception. Their people are very nice to deal with, offices are clean and staff work is efficient. □

COMING IN OCTOBER!

First Annual Hardware Index
Computers in Business and Industry
Introduction to the TEX Language — Part Three
And More!

AND IN NOVEMBER. . .

First Annual Software Index
New Products Issue — Over 300 Items Listed
Plus Feature Articles and Regular Columns

How to Floppy ROM

By Bill Turner, Southeastern Regional

The programs on this month's Floppy ROM* are recorded at two different baud rates. Side 1, "The Automated Dress Pattern," is at 1200 baud in the APPLE format. Side 2, "How to Write Form Letters," is recorded at 300 baud in three formats:

- Cut 1 is in the Intel format at HEX 1000
- Cut 2 is in the Intel format at HEX 0700-099C
- Cut 3 in the TDL relocating format

GETTING THE PROGRAMS OFF THE FLOPPY ROM

To correctly make a system tape of the programs on the Floppy ROM, the following procedures must be followed:

- Begin with a clean cassette tape. This will ensure the integrity of the data stream. If necessary, use a bulk eraser to clear the tape.
- Place the Floppy ROM on the record player and spin it a few times to see that the sound sheet is flat. If necessary, place a coin on the sound sheet to provide traction to the turntable.
- Connect the cassette recorder to the tape output connector of the record player.
- Adjust the volume setting on the record player and cassette to about mid-range. If your system has a VU meter, set the volume setting with the ROM playing for mid-range.

NOTE: It may be necessary to experiment with the volume setting to get the desired undistorted recording.

LOADING SIDE 1: The Automated Dress Pattern

The programs for the dress pattern were written for use with the APPLE II computer system and are in the APPLE format. Once you have the tape prepared from the Floppy ROM, attach the cassette to the computer system cassette interface and type in

HIMEM: 16384 (carriage return)
Load (carriage return — tape recorder should be running)

*Floppy ROM and IAPS are trademarks of INTERFACE AGE Magazine, Cerritos, California.

Load Number 5

Editor and Carl Warren, Senior Editor

The tape will then load the high resolution picture of the pattern parts. This picture will stay on the screen for approximately 15 seconds, then respond with the text page. Each program segment is then loaded as requested by the program.

LOADING SIDE 2: How to Write Form Letters

The loading of this tape is relatively straightforward and only requires that the system uses a 300 baud Kansas City format interface. From this point on, the program(s) are loaded by using the method that works with your system.

The TDL formatted version can be located at any portion in memory by specifying the parameters at loading. For Xitan users the input of R,300 will cause the program to load beginning at HEX 0300.

For any problem with loading either Side 1 or Side 2, refer to Orv Balcom's "Floppy ROM Loading Techniques," March and April 1978 issues of INTERFACE AGE.

WHY IAPS* WAS NOT USED

Originally our plans called for formatting all Floppy ROMs in the IAPS — International ASCII Publication Standard. However, due to the number of responses that were received regarding the IAPS concept with suggestions, corrections and format changes, the decision was made to utilize IAPS on the next Floppy ROM in the January 1979 issue.

The entire updated version with a discussion of the functional purpose and design was presented at the 1978 Personal Computer Convention held in Philadelphia. The text of this talk along with a complete guidebook to IAPS will be published in the November software issue.

ACKNOWLEDGEMENTS

INTERFACE AGE greatfully acknowledges the time and effort of Terry Batt of Midwest Microcomputer, 708 South Main St., Lombard, IL 60148, (312) 495-9889, for helping prepare this Floppy ROM.

We also appreciate the assistance given to us by Chuck Faso and Dave Ruttenberg of Computerland, 9511 North Milwaukee Ave., Niles, IL 60648, (312) 967-1714, in providing the APPLE II for preparing the Automated Dress Pattern. □

By Sandra Evans, Assistant Editor

Computer assisted instruction is the use of computers as an aid to learning. It assists the student by presenting individualized instruction geared to his or her ability. By automatically adjusting the level of work to match the student's ability, the computer is able to raise the student's level of understanding by continually presenting advanced materials. This method of instruction has achieved remarkable success and is being utilized in many public and private schools.

A great deal of computer assisted instruction (CAI) is based on the teaching and reviewing of basic skills. Math, reading and language arts are of primary concern, and the computer's function is to drill the student in those areas in which he or she is deficient.

Programs in math, reading and language arts are divided into strands. Each strand contains an area of concentration on a particular grade level. For example, strands in math deal with addition, subtraction, division, etc. and can range from 1st grade to an adult level. Reading courses are designed for work in vocabulary building, critical reading skills and reading comprehension. Language skills necessary for standard English usage are obtained from a language arts program.

CAI is based on the student's ability to learn from a concentrated exposure for a short period of time. Consequently, computers are used for drill and practice. A concept for study is first introduced by a qualified instructor who teaches it to the students. Once the concept is understood, the student turns to the computer for mastery. The computer presents problems and examples on one level until the student shows competency.

The great advantage of the computer is that it is able to constantly monitor the student's success or failure. When a student begins in a particular area of study, the computer checks the student's level of understanding by computing the percentage of correct answers. If the student is experiencing difficulty, the computer adjusts the strand to present less difficult work. If the student is experiencing a high level of accuracy, the computer raises the difficulty of the exercises to a more challenging level. Because each student's progress can be monitored and evaluated individually, each student receives instruction designed to meet his or her needs.

In addition to constant evaluations, the computer prints out reports on each student's progress. The teacher can use this diagnostic report to determine comprehension, competency and mastery of concepts. Such reports are invaluable in evaluating performance, counseling students and conferring with parents. The computer provides a quick read out which includes the student's grade level in each strand he or she is working in, and the amount of time and the number of sessions which were necessary to progress to that point. In this way the teacher, parents, and student can see what has been accomplished, what new goals need to be set, and how much work may be involved. This process makes computer assisted instruction highly success-oriented.

There are many advantages to CAI, and the most important is the success factor. Because students are confronted with exercises on their own level, they are able to do nothing but progress. They compete with themselves and come to see themselves as the controller of the learning situation.

Peer pressure is relieved because students do not work with others who are on a higher level of achievement. Students are able to work at their own speed until they feel competent in the subject area. As a result, learning becomes a more positive experience, and students gain a self confidence which may not be possible under other methods of instruction.

Many schools have found CAI most helpful with students who have learning difficulties, particularly schools of lower income or minority areas. Faced with a growing frustration from repeated failure, students who begin using the computer-assisted program can meet with new self-approval. Since many students begin to see the computer as a good experience, they come to see the school as a good experience also. As a result, some schools have reported a marked drop in truancy, tardiness and vandalism.

Another important advantage to computer assisted instruction is the aid it provides the teacher. Too often a teacher is faced with an avalanche of paperwork, not only from papers to grade but from records to keep and lesson plans to make. Obviously the computer solves much of that problem. It automatically scores individual lessons, compiles reports which diagnose the results of all lessons to date, and analyzes achievement in terms of percentage and growth. Teachers are left free to provide individualized instruction. More time can be spent with students whose particular needs might otherwise be overlooked. Consequently, teachers can be more in touch with their students.

. . .learning becomes a more positive experience, and students gain a self confidence which may not be possible under other methods of instruction.

Computers are used in many schools and private learning centers. One tutorial center which has concentrated its efforts on the development of a computer-based curriculum is the Center for Basic Learning Skills. With two schools located in Rancho Palos Verdes and Lakewood, California, CBLS is a private institution which accommodates those students who must work on the basic skills of math, reading and language arts.

Upon entering CBLS, a child is tested to determine which skills need tutoring and at what levels. Test results are discussed in a teacher/parent/student conference, and at this time a program is worked out. The student sets short term goals which will be met if the program is continued on a regular basis.

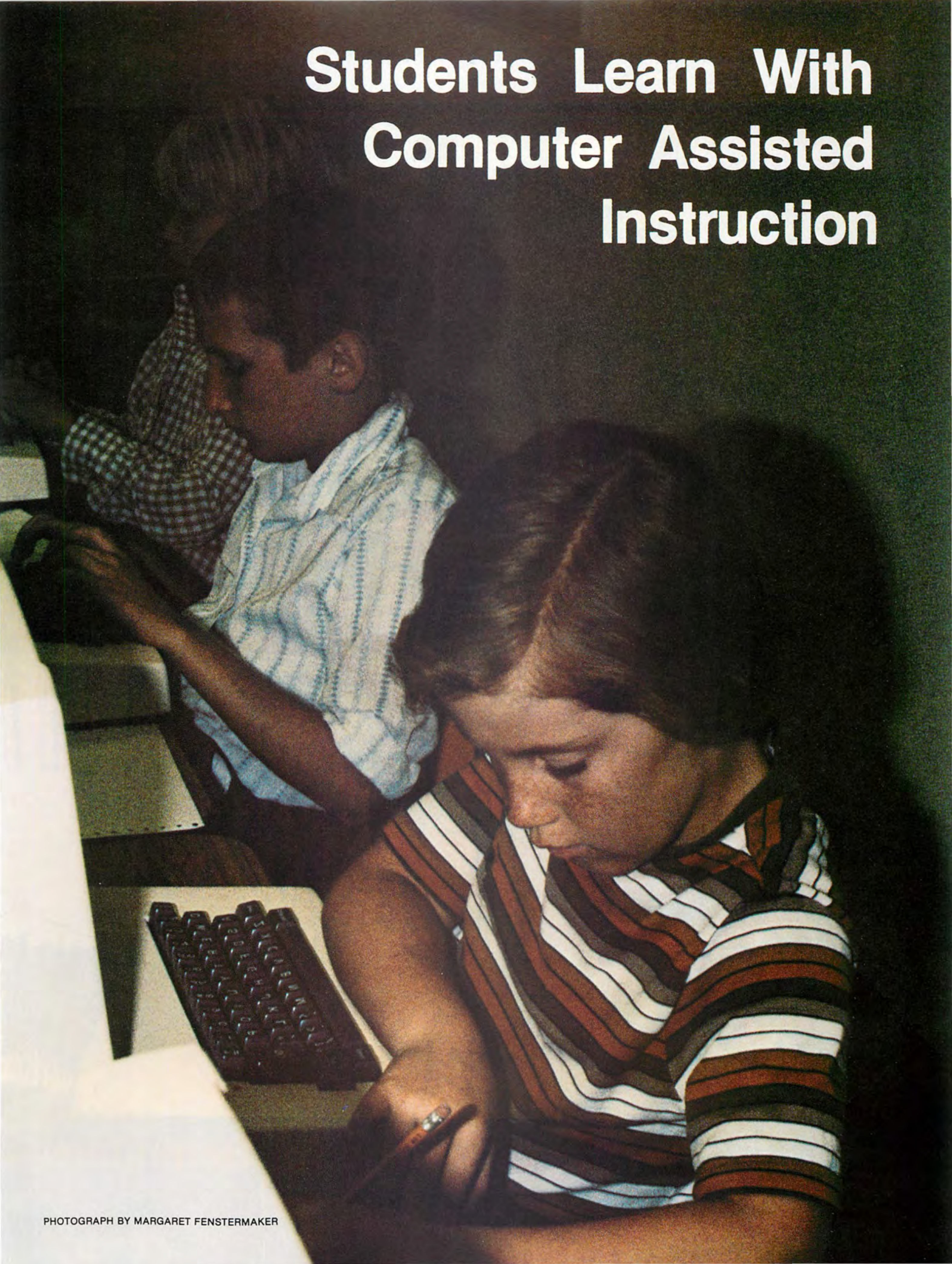
New concepts are taught by an instructor, and then the student goes to the computer for practice. Each student works on a single strand for 10 minutes and then moves to another strand in a different area. For example, a student may drill 10 minutes in fractions, 10 minutes in paragraph comprehension, and 10 minutes in parts of verbs. The average student at the Center can complete approximately 130 exercises in 30 minutes.

The computer tracks the student in about 27 different skill strands, each strand programmed at different grade levels. Students move through the skill strands as they succeed with each lesson. CBLS has found that students who experience a success factor of 90% are able to progress to a higher level, while students experiencing less than 80% are given less difficult work to do.

Students are constantly monitored for achievement. Every tenth session, the computer prints out a diagnostic report which is used by the teacher to determine growth. Another teacher/parent/student conference is held to analyze any problems and set new goals.

It is evident that computer assisted instruction is a proven method of teaching. As an aid to the teacher, it is invaluable in the learning process. Students succeed in increasing their knowledge and find learning a challenging and positive experience.□

Students Learn With Computer Assisted Instruction



PHOTOGRAPH BY MARGARET FENSTERMAKER

PILOT:

A Programming Language for Beginners

By Rita May Liff and Keith Vann

PILOT is a textually-based computer language providing an alternative to algebraic languages such as BASIC or FORTRAN. PILOT is composed of powerful and nearly syntax-free conversation-processing instructions. Its clarity and simplicity have attracted many teachers, students and adults. Originally designed by John Starkweather as an author language for computer-aided-instruction, it is also an excellent language for initiating beginners into computer programming.

In recent years the language of choice for teaching beginners the art of computer programming has typically been BASIC. BASIC is interactive, it is interpretive (errors are caught as the code is being typed in), and it is widely available. At the Lawrence Hall of Science at the University of California in Berkeley, BASIC has been used successfully with hundreds of children and adults. Most students acquire rudimentary skills in BASIC programming fairly quickly but enough have difficulty with the most fundamental algorithms to warrant pause. These students typically lack a strong background in mathematics, and consequently, the inevitable algebraic explanations become exercises in futility. Though the ratio of the "quick" to the "slow" learners of BASIC varies from place to place, one observation is constant — many people initially interested in learning to program are easily frustrated by algebraic languages. There is no reason why such a large number of people be written-off as "unprepared". There needs to be a better way to initiate the unwary into computer programming. There is. The language is called PILOT.

Why PILOT? The many teachers, students and parents who have already mastered PILOT have little cause to wonder. The language is both easy to learn and use.

Most people remember the awesome effort expended learning (and not learning) English grammar. PILOT users appreciate its scarcity of the computer form of grammer, syntax. Furthermore, PILOT has made both input and output exceptionally straightforward. For example, the code which follows instructs the computer to type the message, "DO YOU KNOW MY NAME", and then to wait for an answer. One line takes care of output, **T:** (type)

```
T: DO YOU KNOW MY NAME
A:
```

The other handles input, **A:** (accept an answer). This simplicity characterizes the whole language. Notice, for example, that it is not even necessary to specify a variable for accepting input.

How often can you attain a finished product soon after the idea strikes? PILOT students commonly have that experience. People using PILOT have been able to construct and test their own interesting interactive programs by the first or second session of learning. The power of a textually-oriented, conversational language can be appreciated very quickly, even by people without prior programming experience. At the heart of the language is a feature which makes processing conversation so easy — the "matching" facility.

Through "matching", PILOT can efficiently scan a line of input (in response to a question, for example) for specific words or groups of words. Of the words or sets of words that PILOT attempts to scan for, if but one appears in the input line, the "match" is successful. Any resulting action from the PILOT program may depend upon the success or failure of the match. The example which follows demonstrates "matching".

PILOT types a question	**HOW ARE YOU TODAY?**
Before retrieving the reply, PILOT is ready to "match" these words with the input	(FINE, GOOD, GREAT, OK, FANTASTIC, HAPPY, WONDERFUL, ALRIGHT)
The reply is typed in	**I'M FEELING FINE TODAY**
PILOT types its response after scanning the input	**GLAD TO HEAR THAT**

If the reply were negative, the program would type a different response.

HOW ARE YOU TODAY?
?lousy
CAN I DO ANYTHING TO HELP?

Following is a listing of the PILOT program.

```
T: HOW ARE YOU TODAY
A:
M: FINE,GOOD,GREAT,OK,FANTASTIC,HAPPY,
   WONDERFUL,ALRIGHT
TY: GLAD TO HEAR THAT
TN: CAN I DO ANYTHING TO HELP?
```

- **T:** tells the computer to *type* a message
- **A:** instructs the computer to *accept an answer*
- **M:** holds the words to be *"matched"* (scanned for)
- **TY:** *types* its message *if yes,* the match was successful
- **TN:** *types if no,* the match was unsuccessful

Core PILOT also includes instructions for subroutines and computations, as well as two types of variables. The core language is summarized briefly here. Many versions of PILOT include a wide variety of extensions as well.

THE EIGHT CORE PILOT INSTRUCTIONS

- **T:** type a message
- **A:** accept an answer
- **M:** match for keywords
- **J:** jump to labeled line
- **U:** use a procedure
- **R:** remarks from the programmer
- **C:** compute a result
- **E:** end procedure

TWO PILOT CONDITIONERS

- **Y:** make instruction conditional upon a positive match
- **N:** make instruction conditional upon no match

TWO TYPES OF PILOT VARIABLES

- **$STRING** — for text
- **#NUMERIC** — for computations

PILOT IN THE CLASSROOM

Children and PILOT seem to mix particularly well. PILOT instructions are simple and clear enough to facilitate introducing programming concepts such as: input and output, transfer-of-control, looping, and branching. Consider this program written by a third-grade student from Anna Yates School, in Emeryville, California.

SAMPLE RUN:

```
WHAT IS ROUND
?BALL
AND BRIGHT
?SUN
AND ON THE CEILING
?LIGHT BULB
YOU GOT IT!

*FINI
```

ANOTHER RUN:

```
WHAT IS ROUND
?MOON
AND BRIGHT
?STARS
AND ON THE CEILING
?HANGING LAMP
SORRY, I WAS THINKING OF LIGHT BULB.

*FINI
```

PROGRAM LISTING:

```
         T:WHAT IS ROUND
         A:
         M:LIGHT,BULB
         JY:*RIGHTON
         T:AND BRIGHT
         A:
         M:LIGHT,BULB
         JY:*RIGHTON
         T:AND ON THE CEILING
         A:
         M:LIGHT,BULB
*RIGHTON TY:YOU GOT IT!
         TN:SORRY, I WAS THINKING OF LIGHT BULB.
         E:
```

This riddle program requires branching whenever a correct answer is input so that no further clues are given. The use of the **JY:** (jump if yes) instruction handles the situation nicely and is easy to explain to students.

It is important to consider introducing young children to programming for a variety of reasons. First of all, despite the simplicity of PILOT, the constructs learned will apply to any future programming experience, regardless of how symbolic or abstract the languages used later are. Also, the process of "teaching" the computer to carry on a conversation serves to dispel the myth of a computer's intelligence; students soon realize that it is the programmer who imparts the "wisdom" (or lack of it). This realization is not likely to occur to the same degree through mere interaction with programs written by others. In addition, programming provides a medium for experimentation with different organizational models. Flow-charts and tree-diagrams, and ultimately the programs themselves, represent ways to visualize decision-making processes.

The affective component of education should not be ignored either. Perhaps most notable about the program just shown was the surge of pride in its designer when she sees others enjoying her interactive riddle. This sense of accomplishment is fundamental to learning. Because an interactive program represents a kind of 'game' that the author's peers may want to play, a great deal of motivation is provided. Students work hard at creating the questions and remarks which will be displayed.

The program which follows was designed by three fifth-grade students from Sun Valley School in San Rafael, California. The instructions used are no more complex than those needed to create the simple riddle program. But these students incorporated information they were learning outside of their PILOT class into their program. The students had been studying 'pond ecology' and each group investigated a particular organism. Their PILOT programs were designed to continue giving clues about a 'mystery organism' until a correct response is input or until the clues run out.

THE LISTING:

```
      R:WRITTEN BY FRANCESCA BERTONE, KATHY ROBINSON, JULIE LEET
      R:SUN VALLEY SCHOOL, 5TH GRADE
      R:MAY 13TH, 1974
      T:
      T:WE'RE GOING TO PLAY A QUESTION AND ANSWER GAME
      T:DO YOU WANT TO PLAY
      A:
      M:YES,YEAH,OK,O.K,SURE,FINE,ALRIGHT
      TY:HERE'S YOUR FIRST CLUE:
      JN:*QUIT
      T:TAKE A GUESS.  I AM AN ANIMAL
      A:
      M:SNAKE
      TY:WOW!!!!!!
      JY:*END
      T:I AM A VERTABRATE
      A:
      M:SNAKE
      TY:GREAT!!!!!
      JY:*END
      T:MY LATIN NAME IS THAMNOPHIS
      A:
      M:SNAKE
      TY:FAR OUT!!!!
      JY:*END
      T:I EAT AMPHIBIANS AND INSECTS
      A:
      M:SNAKE
      TY:GOSH, YOU'RE SMART
      JY:*END
      T:I EAT MY FOOD ALIVE
      A:
      M:SNAKE
      TY:CONGRATULATIONS!!!!
      JY:*END
      T:I DO NOT LIVE IN THE POND
      A:
      M:SNAKE
      TY:BY GOLLY, I NEVER THOUGHT YOU'D GET IT SO SOON!!!!
      JY:*END
      T:I GROW TO A MAXIMUM LENGTH OF THREE FEET
      A:
      M:SNAKE
      TY:THRILLS, YOU GOT IT!!!!!
      JY:*END
      T:AREN'T YOU EVER GOING TO GET IT
      T:I'M RELATED TO THE PTERODACTYL
      A:
      M:SNAKE
      TY:I'M AMAZED!!!!!!!!
      JY:*END
      T:I BEAR 50 OR MORE LIVE YOUNG IN THE SPRING
      A:
      M:SNAKE
      TY:GOOD!!!
      JY:*END
      T:I EMIT A FOUL SMELL WHEN SCARED
      A:
      M:SNAKE
      TY:YOU GOT IT
      JY:*END
      T:I DO NOT HAVE EARS
      A:
      M:SNAKE
      TY:HOW DID YOU KNOW???????
      JY:*END
      T:I HAVE A YELLOW STRIPE DOWN MY BACK
      A:
      M:SNAKE
      TY:EXCELLENT!!!!
      JY:*END
      T:MY BODY IS COVERED WITH SCALES
      A:
      M:SNAKE
      TY:YOU'RE SMART
      JY:*END
      T:I AM COLDBLOODED
      A:
      M:SNAKE
      TY:PRETTY GOOD!!!
      JY:*END
      T:I AM A REPTILE
      A:
      M:SNAKE
      TY:FINALLY!!!!!!!
*END  T: HERE'S A CRUDE PICTURE OF ME
      T:
      T:                                 XXXXXXXX
      T:                               XX       .X
      T:       XXXXXXXXXX            XX    XXXX   X
      T:     XX          XX         X    XX    XXXX
      T:    X   XXXXXXXX   XXXXXXXXX   XX          X
      T:   X  XX        X            XX
      T:  X XX           XXX       XX
      T: XXX                XXXXXXX
      T:XX
      T:
      T:                GARTER  SNAKE
      T:
      T:
      E:
*QUIT T:WELL IF YOU DIDN'T WANT TO PLAY THE GAME
      T:WHY DID YOU ASK FOR THE PROGRAM??
```

SAMPLE RUN:

```
WE'RE GOING TO PLAY A QUESTION AND ANSWER GAME
DO YOU WANT TO PLAY
?YES
HERE'S YOUR FIRST CLUE:
TAKE A GUESS.  I AM AN ANIMAL
?DOG
I AM A VERTABRATE
?FISH
MY LATIN NAME IS THAMNOPHIS
?FROG
I EAT AMPHIBIANS AND INSECTS
?TURTLE
I EAT MY FOOD ALIVE
?LIZARD
I DO NOT LIVE IN THE POND
?RACCOON
I GROW TO A MAXIMUM LENGTH OF THREE FEET
?A CAT
AREN'T YOU EVER GOING TO GET IT
I'M RELATED TO THE PTERODACTYL
?LIZARD
I BEAR 50 OR MORE LIVE YOUNG IN THE SPRING
?I DON'T KNOW
I EMIT A FOUL SMELL WHEN SCARED
?SKUNK
I DO NOT HAVE EARS
?A SNAKE
HOW DID YOU KNOW????????
 HERE'S A CRUDE PICTURE OF ME
                                  XXXXXXXX
                                XX        X
       XXXXXXXXXX             XX     XXXX  X
     XX          XX          X    XX     XXXX
    X   XXXXXXXX   XXXXXXXXX   XX           X
   X  XX         X            XX
  X XX            XXX        XX
 XXX                 XXXXXXX
XX

                GARTER  SNAKE

*FINI
```

After writing several of the questions and responses in a program such as this one, students on their own often notice the repetition in code they are generating. When they ask if there is any way to get around writing in this way, it is clear that they are "ready" to be taught about subroutines and other programming mechanisms that will be helpful. In this context, motivation for introducing new concepts has been established.

PEOPLE PRAISE PILOT

"PILOT provides a language which is simple almost to the point of being uninteresting to some computer professionals. But it allows a person with no prior computer experience to interact with a machine in a human way. It provides a newcomer with immediate reinforcement of success, and graphically demonstrates some of the more obvious features of what a computer is like." So says Dr. John Starkweather, author and developer of PILOT. "When I began thinking about a language like PILOT, there was no language oriented toward natural language and conversational interaction. I tried to develop simple mechanisms that would be easily understandable."

PILOT has been appraised as an easy-to-learn language by numerous others who consider it ideal for introducing programming constructs to the novice. At Lawrence Hall Pete Rowe who originally implemented it there remarks, "I could see that some kids had the ability to program, but not with BASIC. There are people who are more word-oriented than numerically-oriented, and I felt they would respond better to PILOT." Joyce Hakansson, coordinator of computer classes there, believes that "there is an organizational skill involved in creating computer programs. . .PILOT gives beginning computer users access to that kind of creation much faster than more traditional languages."

Dean Brown, a long-time advocate of PILOT, has implemented PILOT on a Z-80 and has been responsible for its disemmination internationally. Dean tells us, "PILOT programs have been written in Yugoslavian, French, Spanish and Arabic. . .with support from UNESCO and the World Bank." He feels that "PILOT is so general and flexible there is no point in using other languages for teaching." He notes that when a computer is in a dialog with a student, they are exchanging word strings. "There are only several things that can happen, and they are easy to do with PILOT. You can type in a word string (T:), you can get one back (A:), you can interpret a word string (M:) and branch on content (TY: and TN:). You can also imbed earlier responses in current strings. And PILOT can be learned in a hurry."

Greg Yob has also been influential in spreading the good work about PILOT. In 1975 he formed the PILOT Information Exchange, a clearinghouse for information and resources on PILOT. Greg feels that, "PILOT is likely to become the de facto home computer education language. It's easy to learn, not hard to implement and void of functions unneeded in home education. It's important to have a system not cluttered by things a home user would not be interested in."

Earl Keyser has recently taken over the Exchange. He is implementing PILOT on an Apple II and likes PILOT because "in 8 commands it can do what most author languages do at best poorly and with many more commands . . .It is elegant but not simple-minded." He has found PILOT the preferred language for training teachers to teach their own students computer programming.

WHERE TO GET PILOT

A completely supported microcomputer implementation of PILOT is now available from Processor Technology. Implemented by John Starkweather, it runs on a SOL and may be obtained by writing to:

Processor Technology
PILOT 8080, Version 2.2
7100 Johnson Industrial Drive
Pleasanton, CA 94566
(415) 829-2600

Dean Brown may be contacted for listings of his Z-80 version of PILOT, which runs on an MCZ system. He will also send along sample PILOT programs, some designed for children and others developed in a Creative Writing Course at Stanford. Send inquiries to:

Dean Brown
Zilog, Inc.
10460 Bubb Road
Cupertino, CA 95014
(408) 446-4666

Many other implementations exist, and Earl Keyser has the latest information through the PILOT Information Exchange. Join the Exchange or write to him for resources:

Earl Keyser
22 Clover Lane
Mason City, Iowa 50401
(515) 424-5548

□

ABOUT THE AUTHORS

Rita May Liff has a B.A. in Mathematics and an M.A. in Education from U.S. Berkeley. She is working on an M.S. in Computer Science at U.S. Berkeley. She has developed curriculum, taught and did teacher training in computer and mathematics courses for the Computer Education Project at Lawrence Hall of Science, U.C. Berkeley and has taught computer science and math at Mills College, Oakland, California. She is now a software engineer at Zilog, Inc., Cupertino, California.

Keith Vann is an undergraduate in Computer Science at U.C. Berkeley. He developed extensive curriculum for the teaching of PILOT for the Computer Education Project at Lawrence Hall of Science and is the author of a PILOT reference manual in use at Lawrence Hall.

Computers: Worlds of 'If' for Children to Explore

By Bill Langenes

The following is an interview with Bob Albrecht in which he discusses computer applications in the education field and in the home. His optimistic and creative approach show much promise for the future.

LANGENES: You have been teaching children how to use computers for 16 years. Why should they learn how to use a computer?

ALBRECHT: Because it's fun. They have a wonderful time.

LANGENES: Why are you very heavily oriented to fun and computers?

ALBRECHT: The two universal factors in every culture are music and game playing. After we clothe, feed and provide shelter, we spend our time and money in recreation: either watching other people play games or playing games ourselves. The TV networks will soon find that the number of kids watching cartoons is decreasing. Kids will be spending their time playing much more interesting computer games instead. They will become more active, less passive.

LANGENES: How can computers aid in their education, especially in a classroom setting?

ALBRECHT: I'm working exclusively in the kindergarten through grade eight levels, mostly three through eight. We are using computers for a number of things. First, the computer can be a drillmaster, teaching kids how to add, subtract, multiply and divide. Good examples of this kind of tool are the Quiz Kid and the Little Professor, hand held machines that present math problems to kids that they can respond to. The machine tells them if they are correct or not. Texas Instruments has announced a similar machine called Tell and Spell, complete with voice synthesizer, to teach spelling. It costs less than $50! I know from my experience with very young children that these things work. Kids love them and learn from them.

LANGENES: Do they also learn how to interface with a learning machine?

ALBRECHT: Yes. They get used to dealing with machines that do this sort of thing. The machine is quite patient; it will keep working with you until its battery runs down.

LANGENES: How quickly does the child pick up its use?

ALBRECHT: Almost instantly. You just hand them the machine, spend two or three minutes telling them how to use it, and they'll go off for a couple of hours and play with it. I have several of these units on loan to teachers who tell me they have to take a machine away from one child so another can use it. The informal reporting coming back says that kids really do learn basic skills this way.

LANGENES: Do they learn better, faster, cheaper. . .?

ALBRECHT: Yes. All of those. We're talking about a $12-$15 machine which is doing what some $100,000 time sharing systems I've seen can do. And, of course, the home computer can be programmed to teach basic skills in math, reading and much more.

LANGENES: In addition to being a drillmaster, what else can a computer contribute?

ALBRECHT: The most important things of all are games and simulation that have teaching capabilities. I think that the largest computer markets will eventually be recreation and education, and I'm not sure in what order. In fact, many times we won't be able to know which is which.

LANGENES: What games and simulations are the best sellers — the most effective?

ALBRECHT: Of clear educational value are Guess My Number, Guess My Letter, Stars, Hangman and its variations, the game called Story where the child and the computer interact to create a story, and dozens more.

LANGENES: How about the use of programming?

ALBRECHT: That is really the third educational use of a computer — learning how to program in something like BASIC and applying it to the solution of problems. I've been doing a lot of this with 4-6 graders.

LANGENES: How do they respond?

ALBRECHT: Very well. We are developing ways of teaching small children how to program computers using graphics and verbal activities. We are using the Radio Shack TRS-80 and the Commodore PET microcomputers in a project started in February in Lakewood School, Sunnyvale, California. Lakewood is a K-6 school with about 600 students. We trained a dozen or so 5-6 graders as teaching aides. From February through the end of the year, every one of the 600 children had some exposure to the computer.

LANGENES: How was the program structured?

ALBRECHT: We trained a dozen or so 5-6 graders as teaching aides. The computers moved from classroom to classroom, staying a week in each, with one or two of the teaching aides available to the teacher. Even the kindergarten students were able to use the computer.

LANGENES: What does a computer need to make it an effective teaching tool in the elementary level?

ALBRECHT: We have to make do with what's available. I don't consider anything available now as adequate, so I'm looking to the next generation. Perhaps it should look like the Dynabook™ being developed by Xerox. *People's Computers Magazine* published in the Fall of 1973 a full page sketch and description of a home computer that still hasn't been built. It had encapsulated ROM slots so you could plug in your language. I'm a BASIC booster, but I'm quite ready to get off the BASIC bandwagon. I'm really irritated at its limitations.

LANGENES: A newly introduced personal computer from Exidy called the Sorcerer features plug-in ROM cartridges for various languages, including BASIC and PILOT.

ALBRECHT: Yes, these things are just beginning to happen. I'd also like to be able to plug in Smalltalk or LOGO. So far, the best machine I've used for teaching BASIC is the TRS-80 with its Level II.

LANGENES: What are the features that make it so successful?

ALBRECHT: It's a collection of tiny little things. One is the way the Random Number Generator works. The positioning of the cursor is very easy. The graphics are primitive but easy to use. Another very important feature of the TRS-80 is the ON ERROR GO TO statement. In fact, I can't conceive of anyone not having it in the future. Errors that normally would cause a fatal stop now cause a branch to a line number that allows you to find out what the error is and do something about it. In

addition, the TRS-80 documentation is outstanding — the best I've ever seen from a manufacturer.

LANGENES: What do you like in the PET?

ALBRECHT: The cassette operating system is nice, especially for a naive user. The on-screen editing is nice for writing programs. The graphics are quite interesting. Teachers seem to prefer the one piece construction. I tell schools, whenever possible, to buy both machines.

LANGENES: Why both?

ALBRECHT: If they are going to teach programming, they should do it on the TRS-80 because it is so much easier. I found the PET very difficult to program myself because I keep forgetting what all the funny characters mean. Once the kids get to a certain level of proficiency, they can deal with the difficulty of programming the PET.

LANGENES: Are there other companies that work in the educational setting?

ALBRECHT: I've not yet worked with kids on the Apple II, but I believe it will be an easy machine to teach with. The color is exciting, but the cost is high when you combine it with a color TV. I'm also interested in Processor Technology's SOL because it has PILOT, which is specifically designed for instructional use.

LANGENES: What are PILOT's advantages?

ALBRECHT: It is highly verbal without too many key words or letters. One of its nice features is a MATCH statement which is very useful for instructional dialogue. Golden Gate Montesourri School in San Francisco has been teaching five-year-olds how to program in PILOT for years. PILOT is much easier to learn than BASIC.

LANGENES: How adaptable is BASIC to educational use?

ALBRECHT: I don't consider a language available unless it is in ROM; you've got to turn the machine on and have it go. At the elementary and junior high levels, BASIC is really the only available language.

LANGENES: Is that a limitation?

ALBRECHT: I'd rather have LOGO, but we don't yet. It takes lots of memory and isn't available on a system for less than $1,000, which should be top price for a computer in a classroom. $500 would be even better!

LANGENES: Is it difficult for a child who has learned one programming language to learn a second?

ALBRECHT: It is like becoming an airline pilot. You start with the small planes and move up to the jets. Then when a new jet comes along, the transfer is relatively easy. Once you've learned to program in, say, PILOT, it is very easy to learn BASIC because you've got the conceptual skills. For the same reason, I like to start kids on the TRS-80 and work up to more difficult machines.

LANGENES: Is it the machine or the language that is the difficulty?

ALBRECHT: The language. The little tiny things about the way it is implemented. I wish manufacturers would talk to some of us who spend our lives watching people struggle to use a computer and to program it. It has always been true of the computer industry that the last people to be consulted are the potential users or those who teach the users.

LANGENES: If a teacher asks "How do I learn how to use computers in my classroom?" what advice do you give them?

ALBRECHT: Attend state and national math conferences. The National Council of Teachers of Mathematics (NCTM) annual meeting in San Diego had more than 50 presentations and workshops on calculators and computers. Contact your state affiliate. Maybe the local group has conferences, too. For example, there is a math conference in Anaheim, California, and a California Mathematics Council meeting in Monterey this December.

LANGENES: Are there any how-to-do-it periodicals specifically for computer education?

ALBRECHT: Yes, *Calculators/Computers Magazine.* It is specifically designed to help teachers teach computing. The most important thing Calculators/Computers is doing is providing information on what can be learned through a computer and how you do it. For example, it tells how a game is used to teach and what it teaches.

LANGENES: Where are the well developed school system programs in computer education?

ALBRECHT: Minnesota and Oregon are probably the farthest along in bringing computers to children. Minnesota has at least one terminal or free standing computer in virtually every school in the state. It has two organizations that are beginning to use personal computers to supplement their regional time sharing systems that pump computer power out to the schools. They are the Total Information Educational System (TIES) and the Minnesota Educational Computing Consortium (MECC). The Oregon Council for Computer Education does the same type of thing. The University of Oregon might have the best computer science pre-service education program in the country for education students who are going to become teachers.

LANGENES: What are some examples of successful projects?

ALBRECHT: The Huntington Project at the State University of New York at Stoneybrook has developed 24 computer social studies and life sciences games and simulations for secondary and college use. It received funding from the National Science Foundation, which also funded SOLOWORKS at the University of Pittsburgh. These two projects are the best things NSF has done for schools in my opinion. There is a directory of some 300 elementary, secondary and college institutions recognized as exemplary in the use of computers available from HumRRO, an organization in the Washington, D.C. area.

LANGENES: How many students will be using a computer in the classroom this school year?

ALBRECHT: A few million. Two? Five? I really don't know, and I'm not sure that figure is available.

LANGENES: Are you satisfied with the state of computer education today?

ALBRECHT: No, but I'm not going to worry much about what goes on in the schools because the place where it really is going to happen is the home. The home computer is going to have a big impact. Such an impact, in fact, that education will be forced to reconsider what it is.

LANGENES: In what ways?

ALBRECHT: Education today is too often a babysitting service; with the Proposition 13 type of tax rebellion sweeping the country as it appears it will, schools are going to become more and more a babysitter and less and less an educational establishment.

LANGENES: How will widespread use of personal computers change education?

ALBRECHT: I'd like to see teachers working with children more on a small group and personal basis. The computer can take over a lot of stuff that is frequently done in lecture teaching.

LANGENES: What other changes do you foresee?

ALBRECHT: We're going to have to deal with an incredible diversity of knowledge in children coming to school. There will be a fantastic choice of software, and the software in the home will have a lot to do with what the child learns. We will no longer be able to assume that all kids are entering school with the same level of knowledge.

LANGENES: What will be the long range impact of a generation of children growing up knowing how to use computers?

ALBRECHT: Unpredictable! Joyously, wonderfully unpredictable! I really like to think of computers as worlds of 'if' for children to explore.□

A Place for Personal Computing in Schools and Colleges

By Karl L. Zinn
Research Scientist
Center for Research on Learning and Teaching
The University of Michigan

PHOTOS BY SHELLEY WRIGHT

I like to interpret the domain of personal computing much more broadly than just small, single-user machines. Looking at some experiences with timesharing systems calls to mind useful ideas about communities of learners and occasions for professional communication within such communities. If we limit discussion to small (inexpensive, portable, individually owned) machines, we are not taking advantage of decades of experience with personal computing using costly, fixed systems having the power (processor speed, memory size, instruction set, and complexity) that will be characteristic of the small machine in a few years. I am convinced that the best personal computing is done today on single-user machines, but I haven't given up entirely on timesharing as a means to providing truly personal services. In any case, I want to have communication networks backing up single-user systems in education.

We need to consider computing experiences at all levels of education. Some things are best done in elementary school, or perhaps in preschool programs. Other things fit well in the college learning environment. Some kinds of learning take place best in the home or some other recreational environment, perhaps a community center or library, even a tavern or arcade.

The substance of a number of discussions is presented here in five sections. The first is intended to provide the educator with some indication of why the personal computing revolution is so important to computer use (and information handling) at all levels of education. The second section should inform the computer specialist or enthusiast about kinds of uses in education. The third section offers a list of what may be needed to bring

about some desirable changes in education. The last section provides a brief statement about the future.

FOR TEACHING AND LEARNING

Many colleges and schools have acquired effective and economic timesharing systems for use by teachers and students in teaching and learning activities. These can be expanded to accommodate the increasing amounts of use. Also, they can be extended to handle some new kinds of uses such as graphics and information retrieval systems. However, some kinds of computing will be accomplished more economically with small and inexpensive computers for use by one individual or project at a time. At the University of Michigan, the Center for Research on Learning and Teaching is exploring various roles for these microprocessors and personal computers within school and college learning activities.

ASPECTS OF THE REVOLUTION

The impact of personal computers on education in general and instructional activity in particular will be considerable. Three aspects of the personal computer revolution may help establish this case: numbers, responsiveness, and control.

Personal computers will be used as timesharing systems in much larger numbers than instructional computers have been or will be used as timesharing systems. The major computer-based instruction facility so far has been the PLATO Computer-based Instruction System at the University of Illinois in which the number of simultaneous users are counted in the hundreds. Changes in the system will expand the number of users to thousands. The most common timesharing systems used in schools and colleges today are built by Hewlett-Packard and Digital Equipment. Although these are small systems (four to 60 users each), the total number of simultaneous users served by the hundreds of systems throughout the country is counted in the thousands. With continuing sales to schools and colleges, this number will expand to the tens of thousands.

Dedicated instructional systems and timesharing systems are only part of a small beginning compared to what is about to happen. At least 100 times more personal computers will soon be put to use in education activities. The first line set up to mass produce computers was designed to put out 20,000 per month. With only three smaller companies now delivering machines, the large (potential) producers have not yet announced their products. I expect nearly half a million units to be sold in the first year, and in a few years the number used in education will be counted in the millions. When the measure of expense and capability of a technology improve by two or three orders of magnitude, the effects are more than just quantitative. Personal computers will bring about qualitative changes in education within the home and perhaps in educational institutions as well.

The second characteristic of personal computers is responsiveness. The machine is as available and responds as quickly as a personal and portable electric typewriter or television. But more than that, it responds effectively to more complex directives, rearranging and processing information in a personal way not possible with a shared system designed for the average user. Furthermore, the high transfer rate of data between memory, processor, and display screen opens up new opportunities for realtime animations as well as data analysis.

The third aspect of the revolution is personal control. The owner of a personal computer determines the uses of one or more personal machines and shapes their characteristics to personal needs and preferences. Perhaps the most important aspect of control is the intangible consideration of self-determination; the owner can literally wrap his or her arms around the machine, carry it about, paint it purple, and love it as a pet, as well as reprogram it according to personal preferences.

Detailed characteristics of personal computers and their current uses are receiving careful attention by CRLT staff at the University of Michigan. I will list just a few of the characteristics and limitations found to be significant.

LIMITATIONS

In 1977 the limitations of personal computers may have outweighed their observed advantages for use within learning activities. However, 1978 brought more reliable and powerful models of these inexpensive devices. Indeed, we can expect the capabilities to about double each year without an increase in production costs for at least the next twenty years.

Reliability has been a major problem with many microcomputer systems to date. Now that personal computers are being mass produced, the integrated systems perform much more reliably in educational settings than their predecessors which were usually built by hobbyists from kits. However, the construction of peripherals for printing, storage and the like does not measure up to the same standard of reliability. The major problem faced by manufacturers of peripherals is the need to bring out very low-cost devices comparable with the low cost of the microcomputers themselves. The electromechanical devices for printing, drawing, or storing information on magnetic tape can not be both cheap and reliable. However, the prospects are good for reliable peripherals using new technical developments which will eliminate entirely the moving parts.

Speed of processing is a consideration. Happily, most instructional applications involve simple programs and the observed response from the personal computer is not distinguishable from that of a timesharing system. However, some applications require many computations (e.g., for reducing data or analyzing text), and the delays may just be too great for a student interacting at the slow speeds of an inexpensive, personal computer.

Personal computers do not now provide inexpensive access to large data bases, and updating the data base is an expensive operation if every user has an individual copy. Therefore, the use of inexpensive personal computers in records handling, data reduction, and shared files is not advisable with 1977 technology. This will change by the end of 1978, however.

Compatibility among different personal computers imposes some limits on exchange and marketing of programs. Actually this limitation is no more severe than for sharing programs among different computers made by the same vendor.

Probably the standards that emerge will depend on certain features of the technology: inexpensive, read-only storage, processors which are less expensive than the curriculum storage (e.g., magnetic tape), and audio-visual media which incorporate digital logic and storage (e.g., videodisks).

APPROACHES TO APPLICATIONS

Within current limitations of reliability, speed, storage, and compatibility, CRLT staff already find many applications for personal computers within the University of Michigan today. Machines available in the first half of 1978 already make valuable additions to the resources for learning. Some machines acquired by individual teachers are being used in classroom demonstrations. At least three curriculum development projects are using personal computers in connection with laboratories (preparation for regular lab sessions, information processing aids in carrying out the work, and data generators for simulated laboratory activities). Libraries are considering the use of microcomputers in providing services on campus. Many individual students have purchased machines,

and some of these are being used for work processing (preparation of papers), computation, and information organization and retrieval. The School of Music is using a microcomputer system for music analysis and synthesis, and some electronic music composition.

The implications of personal computing are staggering. Some thought about the future of computing in education and society may help teachers establish a useful perspective on increasing computer use by students today. This topic has been written on at length, and therefore I will list just three aspects I believe to be very significant for educators considering the general topic of computers in education: computer literacy, home entertainment, and computer-based videodisks.

A general literacy about computers is likely to be as widespread as the knowledge of driving a car. Already electronic calculators have become so inexpensive and straightforward to use that nearly anyone can acquire a convenient device to carry in a pocket or purse, or wear on a wrist. The impact has been primarily one of accomplishing calculations more reliably. As general information processing facilities become as common as the portable home typewriter or television set (indeed, they will no doubt be incorporated within home typewriters and television sets), a general literacy about their use will develop rapidly. To some extent this literacy is already being accomplished in computer courses in schools throughout the country. Self-instruction at home will take care of the rest. Nearly all students will know how to AND EXPECT TO use computers.

This year, microprocessors have become a significant part of the home entertainment industry. Computers are evident in video games which duplicate arcade devices and in board games which play a fair game of chess, checkers, othello or backgammon. As general-purpose computers become incorporated in home entertainment centers, the capabilities for simulation, modeling and records handling will expand rapidly. An important part of the home market will be self-education. Many companies will be selling learning packages which include computer programs to run on the home computer as well as supplementary materials and guidebooks.

New developments in videodisks may revolutionize personal computers. For some years companies have been working on one version or another of the home videodisk. One of the driving forces behind this movement is the expected market for old movies and special interest programs in the home. However, in order to solve some of the technical problems of retrieving the bits of information which make up a video signal, the researchers turned to certain digital techniques which are of considerable interest to computer designers. It appears now that including a microprocessor in the videodisk player will make it more practical, reliable, and economical.

Computer control of the videodisk player provides an exciting resource for educational use of microcomputers. A small archive of movie clips (30 minutes total), a very large archive of color still frames (54,000), or any combination of these can be searched and controlled by a personal computer. This means one can retrieve, display at regular speed, slow motion or still frame, and move to another section of the file based on instructions from the push-button controls and the history of interaction with the particular learner. Furthermore, one can set up the personal computer to interpret the 54,000 frames of video as nearly 100 million bits of digital memory. This reduces considerably the present restrictions on microcomputers for handling large data bases.

These future prospects are quite exciting and probably will bring significant and desirable benefits to education and to society.

SUMMARY OF TRENDS IN COMPUTING, COMMUNICATION AND THE LOCUS OF EDUCATION

A number of changes in the technology of computing and communications, and changes in education and society, have increased professional interest in computers for learning and teaching. Four points deserve attention. 1) The low cost of microcomputers merit rethinking uses of technology in education. 2) Inexpensive communications may shift the role of centralized educational computing. 3) Incentives will improve for commercial production of materials for training and continuing education. 4) Home computing, combined with other technology, will support a trend toward more education in the home.

The low cost and easy use of microcomputers are providing access to highly interactive computing, *including* graphics, for many more people and projects. Video techniques, such as the microcomputer-based videodisk player, are enhancing graphics and low-cost storage for instructional computing. The economic and social pressures on educational institutions are forcing decisions by state and federal agencies and by individual institutions to support additional use of technology.

Dedicated instructional systems and timesharing systems are only a part of what is about to happen. Personal computers will bring about qualitative educational changes. . .

Inexpensive communications have been promised via satellites and optical fibre telephone lines. Very low cost and very large memories are proposed for educational timesharing systems. When these developments are realized, the cost of centralized educational computing systems will drop significantly. This cost improvement will help restore some of the education market for timesharing taken over by personal computers, but also it will increase the use of personal computers through low-cost support networks.

Commercial incentives are emerging in the U.S. now that packaging is becoming more practical and the educational market is becoming interlinked with other computer uses. For example, recreational uses of personal or home computers include some instruction for the very young learner. Professional uses by the adult practitioner include some new opportunities for learning. New markets for training and continuing education have focused attention on the need for improved instructional design.

People who work with computers in education will have to pay attention to the dramatic development of personal computing. Already considerable educational activity takes place in the home, and more money is spent on home educational materials, games and correspondence in the U.S. than on materials for institutionalized education directly. Also, the home market is more attractive than the institutional one. I am sure a great deal of computer use in education and training in the next decade will be through inexpensive but rather capable machines purchased for personal use in the home and office.

All of these current developments cannot be covered in the pages of this article, nor have we in our discussions done more than scratch the surface. However, this

article can be used together with others in this issue to expand your view of microcomputers and uses of personal computing in education and to establish means to keep in touch with a diverse and rapidly changing field.

KINDS OF USE

LEARNING ABOUT THE COMPUTER

Learning about the computer is the most rapidly growing area of Computer Assisted Learning (CAL). Computing within instruction follows quite naturally from the introduction of computers into many parts of society and into homes directly. As experience with computers becomes commonplace for a class of learners, educators can use the computer and its procedures as metaphors for other processes and constructs. Education about computers provides tools useful in other learning. The following paragraphs comment on computer literacy, professional development, in-service training of educators, and personal computing.

Computer literacy for all students is established now in some college. Computer programming may be required (or assumed and offered only as a non-credit course), so computing skills can be put to use in courses like mathematics, sciences, and engineering. The extent of computer literacy throughout the U.S. is still very low, but inexpensive computing devices and the popularity of the activity with students will increase the percentage dramatically in the next few years.

Professional development regarding computer use is common for many areas already; accounts, bankers, engineers and others whose professional activities depend on automatic computation and information processing are refreshing skills and obtaining new ones. Additional professions are finding computer assistance indispensible, and information is now offered through special courses and institutes for architecture, law, medicine, and others.

In-service training of teachers is essential if public education is to catch up with the rapid change of technology. University institutes offer skills training during the school year and in the summer. Sound information and constructive attitudes regarding computers in education are essential to the success of new programs in public schools.

Personal computing in homes shows the greatest prospect for impact on learning about the computer. By the end of 1978, I expect personal computers to be in use in nearly half a million homes and offices. Many of the purchasers will use these devices only with packaged application programs, as are the preprogrammed video games, but all the equipment will be programmable and include convenient local storage for saving user-designed programs.

LEARNING THROUGH THE COMPUTER

In the past, the core of educational computing activity was drill, practice, diagnostic testing, and question-and-answer tutorials. Today these continue to be the major modes of learning in operational systems (e.g., the PLATO System of the University of Illinois and Control Data Corporation, Computer Curriculum Corporation systems, Hewlett-Packard and Digital Equipment timesharing systems, and the Univac system). Even though these modes will be overshadowed for a time by a dramatic growth of learning about and learning with the computer, they will remain viable instances of computer applications, readily accepted because of their familiarity, moderate cost, and convenience of total systems. Personal computers will take over delivery of instruction only after they incorporate the necessary storage facility for curriculum materials and performance data, and only to the extent their owners wish to use them in that mode.

LEARNING WITH THE COMPUTER

The computer as an aid to learning, and an adjunct tool for the learner, is taking on new dimensions now that computing is inexpensive and portable. Hand calculators used in the laboratory, classroom, and study hall have taken on the characteristics of computers: stored programs, program libraries, peripheral storage, printers, graphics, etc. As these least expensive computing devices incorporate general characteristics, the general-purpose computers are decreasing in price to match the calculators. Practical uses include simulation, gaming, problem solving, and creative activities.

Simulation and gaming have always been popular with teachers and students. Now these entertaining activities are appearing in academically respectable textbooks and laboratory materials.

Problem solving activities once required knowledge of programming, unless cleverly imbedded in a tutorial sequence which prompted for the parameters and equations or whatever was needed. Now problem-oriented languages and familiarity with keypress sequences on programmable calculators put problem solving in reach of any learner experienced in the discipline. Students can be asked to turn a problem solving facility on the timesharing system or a microcomputer (or a calculator at hand) to carry out some computation or modeling activity.

Creative activities in education are aided by computers very nicely, at least in experimental systems. Perhaps the most impressive overall is the first approximation to the "dynabook" developed by Alan Kay and his colleagues. Young children are able to sketch, animate, compose music, arrange words in poetic forms, and carry on many other creative activities usually reserved for specialized and advanced users of computers.

LEARNING SUPPORT SYSTEMS

Computer managed learning is expanding within the U.S., albeit quietly and often without any note of the computer role. A significant percentage of schools are using computer systems to aid in classroom management.

Information management goes beyond instructional management to help the student as well as the instructor with information needs. Guidance systems have become quite popular, including SIGI of Educational Testing Service.

The automatic generation of learning and testing materials by computer will soon become a common activity among computer aids. Some tools are already quite popular, especially computer assisted test generation. Delivery is easily handled on today's microcomputers.

AREAS OF INSTRUCTION

The broad range of computer uses can be shown by selecting some of the less likely uses in six areas of instruction: math, sciences, social sciences, arts and humanities, languages and communications, and the professions. The few instances given here represent only a small part of all the computer aided learning curriculum materials.

Students in a mathematics course have used a simple computer language (LOGO) on a mini timesharing system or a micro to generate a mathematical system building from primitive elements.

In a laboratory course in chemistry, preparation for use of titration equipment is aided by conceptual experience provided economically to individual students who use the graphic animation capabilities of the PLATO System (or the Commodore PET) before they go into the laboratory.

A simulated laboratory provides research experience for undergraduate students in psychology. The computer is used as a data generator. The value of the simulation depends on the activity of a classroom research

community and the effectiveness of the teacher as a consultant.

In the arts and humanities, computing serves as a medium of communication as well as a tool for creative work. Perhaps the most interesting instructional use in humanities today is as an aid for scholarly work by the student. Graduate students of literature have used pre-programmed applications packages in exercises to determine authorship or analyze style. Undergraduate students explore rules of language through computer generation of poems and stories. So far I have seen these applications only on large machines, but very capable work processing systems on micros are suggestive of what is coming.

In language learning, aid in practice of skills is the dominant computer use. Contrary to the idea that the cost of development needs to be distributed over many students, two professors at Stanford University are programming computer assistance for a dozen specialized courses which have such low attendance that the department of Slavic languages cannot afford to staff them. With this assistance (tutoring, drills, and practice exercises) the professors plan to handle a larger number of students and in a greater variety of courses than previously possible.

Preparation for professional work accommodates as much computer use in training and education as anywhere. For example, management games are very popular in business education and natural resources; simulated cases are used in law and medicine; and design exercises depending on computer assistance are common in engineering and architecture.

One of the most innovative applications is computer assistance for advanced seminars which bring together graduate students from different departments for study of a problem area (e.g., energy conservation, regional planning, or technology assessment). Each participant uses computer assistance for organizing information from diverse and sometimes unfamiliar areas, communicating in writing with others in the seminar at times other than their regular, face-to-face meetings, and drafting working papers for review by the group. The organizers of the seminar keep the group focused on the problem without minimizing important background material and call on resource people who might not otherwise have time to participate except for the convenience offered by computer-assisted conferencing. This enables them to respond at any time of day, any day of the week, and from any user terminal or personal computer which can connect to the computer or network handling the conference.

NEEDED DEVELOPMENTS

NEEDS AND ISSUES

Further development of computer assisted learning in the U.S. will interact with a number of needs and issues related to the technology as well as to educational applications. Three such issues are listed below.

Microelectronics technology, with rapidly decreasing costs which depend on greatly expanded usage, is forcing producers to find new markets for computers and related technology in education as well as throughout society. Appropriate uses in education require planning for and managing the design of the technological aids and their introduction into educational activities and institutions. Personal computing is being marketed strongly in the U.S. and will be taken up in the next few years by many people for entertainment and small business purposes. The equipment in which industry is investing large sums of money for the personal computer market wil not serve educational purposes well without attention to considerations of design specifically for educational purposes.

Education faces serious problems of financing, access, credibility, and the like. Certain of these difficulties can in part be eased by appropriate uses of technology if resources are available at the right time and place for research, development, evaluation, demonstration, diffusion, and operation. Otherwise, significant opportunities to aid all learners, and in particular the disadvantaged, the handicapped, the gifted, and the isolated learners, will be lost.

General literacy in computing and information systems will be required by all, consumers as well as vendors, employees as well as managers, and learners as well as scholars, if society is not to be disrupted by a revolution encouraged by rapid growth of technology needed to support today's "information society." Computer literacy can begin in elementary school, and sooner. However, because of the rapid introduction of the technology in many areas, computer literacy training must be carried on in colleges, professional schools, certification programs, on-the-job training, community education, and public media reaching the homes.

Of course, other problems and issues may be at least as important as the three listed above. I have tried with this summary statement to express the nature of the current situation for computer assisted learning.

AREAS FOR POSSIBLE ACTION

One major need at the national level is for coordination of planning and funding. Many important matters, e.g. goals, standards, and credibility, can be accomplished only through national discussion and action. The funding necessary to meet the needs in this area can no longer be handled piecemeal through many different agencies. The commitment to excellence in education and to effective use of technology must come from the top.

Information systems in education and society cut across many areas: research, development, handicapped, gifted, elementary, and professional. Useful information and good advice on these matters has been accumulating for over 15 years in the form of recommendations of national commissions (National Academy of Sciences, 1966; President's Science Advisory Committee, 1967; Commission on Instructional Technology, 1970; Carnegie Commission on Higher Education, 1972), professional organizations, and review projects. A new commission or conference can begin with the recommendations of earlier efforts, review the present state of technology and institutions, and take thoughtful action. Action is necessary now in response to the pressures and problems. Furthermore, benefits are more easily justified today in light of the dramatically improved economics for applications of microelectronics and telecommunications.

Designated centers with good support could provide sites of excellent training, development and research. Potential users urgently need the most current information, the best training, and an optimal environment for development activity. Residencies would provide an opportunity for individuals to get away from regular responsibilities to initiate new work. Research opportunities would be increased significantly by bringing together creative individuals with necessary resources and a variety of learning environments. Large-scale exploration of technological opportunities and basic concepts of learning would become practical. Alternative systems and approaches to curriculum could be compared within the same environment.

Immediate action to give educational uses for computers an identity different from data processing would, in some organizations, facilitate obtaining equipment necessary for meeting institutional goals at lesser costs. Instances include public education as well as military training, and state and local support as well as federal.

Immediate action to recognize computing and information processing as a significant part of basic education would set in motion the process of curricular revision necessary to the information age. In a few years all students in public schools would become familiar with computers, programming as well as applications, by about the eighth year of school. The later teachers for these students could then assume long familiarity with computers and put the personal equipment to good use.

Curriculum development requires special attention since computer use in education is a new industry, as yet untested and lacking incentives for developers and distributors. Commercial publishers cannot be expected to initiate high risk ventures, and yet they may be left behind if the computer vendors try to provide curriculum materials. Universities and colleges have much to contribute since most textbooks originate there today. Individual authors need to see rewards, both academic and economic, for their efforts.

A computer-based lab in which learners explore their own abilities may help in areas such as inter-hemispheric communication and enhanced mechanisms of recall. . .

The social implications of dramatic changes in availability of information and automatic processing require attention. Every elaborate clipboard or binder will have a small pocket for a specialized calculator. Every reference book or procedures guide will have imbedded within its cover an information processor suited to the subject. Each desk encyclopedia will include sounds and animations and a microprocessor which conducts searches of the entire text as well as selects from the contents, index and cross references.

Planners need to consider the implications of new modes of representation and communication with machines, new skills for learning, problem solving and creative activities, new roles for teachers and managers, new situations for learning at home, on the job, and in the community. Administrators need to plan systems so that increased dependency on information macines, for assessment of ideas as well as retrieval of information, will not become an inappropriate crutch.

Communications between people and machines needs careful attention. As long as the students (or other casual users) need to type on a keyboard and watch for text and numbers and simple diagrams to appear on a special screen, these machines will have a rather narrow application in training and education. However, when a user can talk to the machine and get a response not just in printed text but in spoken words and other sounds, and can see the effects of his or her directives in the actions of equipment such as models and tools, then the computer will fit into a much larger world of learning.

Additional areas for possible action at least as important as the eight listed above can be added. For example, through computers special opportunities become available for the gifted student. Dramatic improvements in communication and learning are achieved for the handicapped: Kurzweil's reading machine and Telsensory's talking calculator and Braille output device for the blind, and similar specialized equipment for the deaf.

Other aspects of the technology provide facility for producing speech, processing knowledge, and building personal skills for learning and performance.

FUTURE

NEW MODES OF REPRESENTATION AND COMMUNICATION

Future developments will extend the modes of communication possible between the learner and the machines. Speech and other sounds will become suitable for entry into the machine as well as for output. Gesture and other motions will be interpreted usefully. These developments will bring immediate benefits for those lacking some standard sense or accepted communication means. For example, computer-assisted communication will revolutionize Braille for the sightless, and provide random access to audio and other personal notes. Already an application of microcomputers provides speech to those who have lost it through accident or cerebral palsy. Physiological measures will be incorporated as input, opening up new channels for persons lacking the motor control necessary to operate typewriters or to speak.

Information will be represented with improved graphic and audio means using networks and other data structures. The exploration of knowledge will be more directly available through manipulation of structure, organization, and dynamic interactions by the learner. The student will, with assistance of information processing routines, work effectively within a personalized and dynamic information base. This development will depend on considerable literacy in information handling using computers.

NEW SKILLS OF LEARNING, PROBLEM SOLVING AND CREATIVE PRODUCTION

Computer assistance will help learners arrange multiple views of text and graphics. Skills of speed reading will be extended by aids for immediate comparisons and cross references among sections of text. Facility with graphics will extend far beyond the multi-media shows of today. Authors of textbooks and reference materials face new challenges in applying the technology and anticipating improved skills of users.

Problem solving skills will expand in more directions than can be anticipated. Induction may be facilitated by interactive, computer-assisted deduction. Proof of the four-color map problem by students with computer assistance is only a beginning. More creative solutions to engineering problems will be especially effective.

Artistic creations will similarly be extended beyond our present abilities to comprehend and appreciate. For a primitive example, consider today's dynamic sculpture for which a sound-light score interacts with the movements and speech of its observers. Young artists will find many new opportunities, and the world of creative art will be opened to those previously excluded by physical handicaps.

Previously untapped capacities for learning and performance will be put to use. A computer-based lab in which learners explore their own abilities may help in areas such as inter-hemispheric communication ("using both sides of the brain") and enhanced mechanisms of recall and pattern recognition. Unanticipated and dramatic benefits may follow from the development of synergism of the human user and various machine information systems. Some of the most significant benefits may be obtained with the enhancement of communication within communities of all sizes.

The United States does not have the only innovative projects working in these areas, as is apparent when reading other articles reporting on developments elsewhere in the world. Extending communication, processing knowledge and building personal and interpersonal skills are important areas for future development anywhere in the world of personal computing and learning today.□

The Automated Dress Pattern for the Apple II

By Wm. V.R. Smith III

Side 1 of This Month's Floppy ROM*

The automated dress presented in this article and on the Floppy ROM was made available to INTERFACE AGE by the McCalls dress pattern company and is reprinted here by permission.

The concept of automating useful everyday items has been the goal of the microcomputer industry. The computer is quickly becoming a practical appliance for the home. Already the APPLE II has the capability of being part of a telecommunications network to check the stock market. Before long the era of electronic mail will be as commonplace as the mailman is today.

Imagine the possibility of the homemaker deciding to make a dress and going to her television to check a database for the type that is wanted. She could decide to make the "Make It Tonight™" pattern by McCalls. The next action is to request the pattern and have it printed on the household printer or facsimile machine.

Exciting idea, isn't it? The possibility not only exists but is available on the Floppy ROM supplied on page 80a of this issue. It's not quite the ideal master database but is still portable and useful.

WHAT IS NEEDED

In order to use the automated dress pattern, it is necessary to have the following equipment:

- •An APPLE II with 16K of memory
- •A record player to make the system tape from the Floppy ROM
- •A 132 column printer

This equipment lineup provides the ideal situation and makes it possible to quickly use the supplied routines.

THE PROGRAM DESIGN

Patterns and pictures must be formatted and compacted for data transfer. The most difficult patterns to compress are those which are bulky in nature. A typical dress pattern, which requires a 132 column line printer for reproduction, proves to be a good test for a formatter of this type.

The pattern processor, shown in Program 1, will reproduce any pattern that is desired. The important point when using this portion of the program is: dress making is not as easy as it sounds, and the original documentation supplied with the dress pattern must be followed.

One of the prime considerations in pattern compacting is the definition of the equipment which will ultimately be used to reproduce it. As mentioned earlier, the pattern used for this program was designed for a 132 wide column printer. Therefore, each point of the dress must be in one of 132 columns and on one line of the paper (Figure 1). This was done originally by tracing the pattern onto the 132 wide column paper and defining the characters that would be used to represent the points. For this application asterisks and colons are used for the pattern points.

Once the points are determined, compacting is performed by converting a string of characters into a simple code. The most obvious string is a line of asterisks or colons. The code is then established to advise the processor that a line of characters will be printed and in which column to begin and in which to end. The code must fit into the computer's memory along with the necessary status flags. One byte instructions of up to 255 possible code combinations are used. The first 132 are reserved for the columns with the remaining codes established by the programmer.

---

*Floppy ROM is a trademark of INTERFACE AGE Magazine, Cerritos, California.

For the "Make It Tonight™" dress pattern, ten pages of pattern were compacted into ¾K of memory using the formatter in Program 1.

Although the concept represented here is for a dress pattern, the basic idea is the same for compacting data for maps, schematics, pictures, and diagrams, which will make it possible to quickly transfer design data and make storage of valuable designing plans much easier.

THE DRESS MAKER

The program that handles the actual creation of the dress pattern is shown in Program 2. This program provides the functions shown in the program menu (Figure 2).

It is important to point out that the dress pattern chosen for this experiment is designed to fit sizes 9 to 13. No provision was made in this program to dynamically adjust the pattern size. Any modifications to the size are made by using the McCalls Fitbook. However, the possibility to dynamically adjust the size does exist. This is based on the idea that each portion of the dress pattern changes by a specific ratio, which then makes it possible to use an algorithm that takes the original data (Programs 3 through 6) and scales it either up or down. Of course, this will only work within the limitations of the printer size.

The processing program makes the assumption that each part of the dress is a unique entity and is defined by the points in the database. Table 1 describes the function of each of the data programs 3 through 6.

TABLE I

Pattern #	Program #	Lines
Front Yoke dress b	3	1000-10C8
Front Yoke dress b	4	1000-1060
Back and Front	5	1000-10D0
3 Patterns Tiebelt Arm Hole and Binding Ruffle	6	1000-12B0

SUMMARY

In creating the automated dress pattern, some reservations as to practicality were encountered. The major concern is of what use will it be. Nothing really new in this industry. The use is in the functional concept of automating dress patterns or sail boat plans. The plans are available in total for the price of a low cost media such as a magazine.

Also important in the concept is the ability to develop an automated library of useful designs that can be restructured at will.

In a later issue of INTERFACE AGE, the structure of the necessary algorithm to restructure designs will be presented. But for now, program the pattern and teach your wife how to use the program.☐

ABOUT THE AUTHOR

Wm. V.R. Smith III studied computer science at the University of California at Northridge and is now a partner in Softape, a software company involved in the development of software for microcomputers. The author can be contacted at Softape, 10756 Vanowen St., North Hollywood, CA 91606.

PROGRAM LISTING 1

```
 100 DIM A$(100),S$(50)
 105 CALL -936
 110 S$=" *:=+-#$%!ABCDEFGHIJKLMNOPQR
     STUVWXYZ<>;.0123456789"
 199 X=4098
 200 REM
 300 PRINT X-4097;" IS ";: INPUT
     A
 305 IF A=0 THEN GOSUB 6000
 310 IF A=170 THEN 4000
 350 POKE X,A
 360 IF A=240 THEN 5000
 400 IF A=0 THEN 700
 410 IF A=150 THEN 2000
 420 IF A=160 THEN 3000
 450 IF A=250 THEN 7000
 600 X=X+1: GOTO 200
 700 POKE 4096,X MOD 256: POKE 4097
     ,X/256
 800 INPUT "WANT TO SAVE ",A$: IF
     A$(1,1)="Y" THEN GOSUB 950
 900 END
 950 INPUT "1 - DISK; 2 - TAPE",
     A: IF A=2 THEN 1000: INPUT
     "FILE NAME ",A$
 960 L=X-4096: PRINT "BSAVE ";A$
     ;",A4096,L";L
 970 END
1000 POKE 60,0: POKE 61,16: POKE
     62,1: POKE 63,16: CALL -307

1100 POKE 60,2: POKE 61,16: POKE
     62, PEEK (4096): POKE 63, PEEK
     (4097): CALL -307
1200 RETURN
2000 REM ********************
2001 REM  WORDS IN FILE
2002 REM ********************
2010 X=X+1: INPUT "TAB COLUMN # "
     ,A
2020 POKE X,A
2030 X=X+1: INPUT "TYPE MESSAGE "
     ,A$
2040 FOR I=1 TO LEN(A$)
2045 FOR Y=1 TO LEN(S$)
2050 IF A$(I,I)#S$(Y,Y) THEN 2060
     : POKE X,Y:X=X+1
2060 NEXT Y,I: POKE X,255: GOTO
     600
3000 REM *********************
3001 REM      REPEAT
3002 REM *********************
3010 X=X+1: INPUT "TAB COLUMN # "
     ,A: POKE X,A
3020 X=X+1: INPUT "REPEAT TO COLUMN #
      ",A: POKE X,A: GOTO 600
4000 REM *******************
4001 REM  CHANGE CHAR
4002 REM *******************
4010 INPUT "CHANGE TO WHAT CHAR "
     ,A$
4020 FOR I=1 TO LEN(S$)
4030 IF A$#S$(I,I) THEN 4040: POKE
     X,169+I
4040 NEXT I: GOTO 600
5000 REM
5001 REM *****************
5002 REM  SET COLUMN CHR
5003 REM *****************
5010 X=X+1: INPUT "COLUMN #",A: POKE
     X,A:X=X+1: GOTO 4000
6000 REM ********************
6001 REM     MENU
6002 REM ********************
6010 PRINT " 150 - ASCII STRING"

6020 PRINT " 160 - REPEAT CHAR "

6030 PRINT " 170 - CHANGE CHAR."

6035 PRINT " 240 - SET COLUMN   "

6037 PRINT " 250 - REPEAT LINES"

6040 PRINT "   0 - END"
6050 PRINT : INPUT A: IF A#0 THEN
     310: GOTO 700
7000 REM
7001 REM *******************
7002 REM    PRINT L LINES
7003 REM *******************
7010 INPUT "REPEAT HOW MANY TIMES "
     ,L
7020 X=X+1: POKE X,L
7030 GOTO 600
8000 REM
8001 REM  PATTERN FORMATTER
8002 REM
8003 REM  CREATED BY WM. DEPEW
8004 REM  AND WM. SMITH : SOFTAPE
```

PROGRAM LISTING 2

```
0 DIM S$(50),A$(30),P(135)
1 REM  AUTOMATED DRESS PATTERN
2 CALL -936
3 P=2
4 LEN=131:P1=1
5 FOR V=1 TO 132:P(V)=1: NEXT
  V
6 S$=" *:=+-#$%!ABCDEFGHIJKLMNOPQR
  STUVWXYZ    0123456789"
10 REM  AUTOMATED DRESS PATTERN
20 VTAB 2: PRINT "MCCALLS DRESS PAT
   TERN #6066": VTAB 4: PRINT
   "FOR USE ON ANY 132 COLUMN PRINT
   ER"
30 VTAB 10: TAB 9: PRINT "1 - LOAD
   A PATTERN FROM CASSETTE": VTAB
   12: TAB 9: PRINT "2 - PRINT PATT
   ERN ON PRINTER"
40 VTAB 14: TAB 9: PRINT "3 - INSTR
   UCTIONS FOR DRESS"
50 VTAB 20: INPUT "YOUR SELECTION #
   ",C
70 IF C=1 THEN 7000
75 IF C=3 THEN 9000
80 CALL -936
100 LP=1:P=2
110 ABLE=4096:ABLEEND= PEEK (ABLE)
    + PEEK (ABLE+1)*256
120 FOR X=ABLE+2 TO ABLEEND-1
130 B= PEEK (X)
140 IF B>132 THEN 150: GOSUB 1000
    : GOTO 210
150 IF B#150 THEN 160: GOSUB 2000
    : GOTO 210
160 IF B#160 THEN 170: GOSUB 3000
    : GOTO 210
170 IF B<170 OR B>230 THEN 180:
     GOSUB 4000: GOTO 210
180 IF B#240 THEN 190: GOSUB 6000
    : GOTO 210
190 IF B#250 THEN 200: GOSUB 8000
    : GOTO 210
200 PRINT "ERROR IN DATA": END

210 NEXT X
220 PRINT
250 PRINT "HIT ANY KEY TO CONTINUE"

252 IF PEEK (-16384)<128 THEN 252
    : POKE -16368,0: GOTO 2
1000 REM  ******************
1001 REM     CHAR PRINT
1002 REM  ******************
1010 GOSUB 5000
1020 PRINT S$(P,P);
1025 LP=LP+1
1030 RETURN
2000 REM  ******************
2001 REM     PRINT WORDS
2002 REM  ******************
2005 X=X+1:B= PEEK (X)
2010 GOSUB 5000
2020 X=X+1:B= PEEK (X): IF B=255
      THEN 2030:LP=LP+1: PRINT S$
     (B,B);: GOTO 2020
2030 RETURN
3000 REM  ****************
3001 REM      REPEAT
3002 REM  *******************
3005 X=X+1:B= PEEK (X): GOSUB 5000

3010 X=X+1:B= PEEK (X)+1: FOR LP=
     LP TO B-1: PRINT S$(P,P);: NEXT
     LP
3020 RETURN
4000 REM  ******************
4001 REM  CHANGE CHARACTER
4002 REM  ******************
4010 P=B-169: RETURN
5000 REM  ******************
5001 REM   POSITION & PRINT
5002 REM  ******************
5010 IF B>=LP THEN 5015: FOR LP=
     LP TO LEN: PRINT S$(P(LP),P(
     LP));: NEXT LP: PRINT :LP=1

5015 IF LP=B THEN RETURN
5020 FOR LP=LP TO B-1: PRINT S$(
     P(LP),P(LP));: NEXT LP
5030 RETURN
6000 REM
6001 REM  *****************
6002 REM    SET COLUMN ON
6003 REM  *****************
6010 X=X+1:B= PEEK (X):X=X+1:C= PEEK
     (X):P(B)=C-169
6100 RETURN
7000 REM  *****************
7001 REM  CASSETTE LOAD
7002 REM  *****************
7003 INPUT "1 - DISK; 2 - TAPE "
     ,A: IF A=1 THEN 7100
7004 CALL -936: VTAB 10: PRINT "TURN
     TAPE ON AND HIT RETURN"
7005 IF PEEK (-16384)<128 THEN 7005
     : POKE -16368,0
7007 VTAB 20: TAB 10: PRINT "LOADING
     PATTERN"
7010 POKE 60,0: POKE 61,16: POKE
     62,1: POKE 63,16: CALL -259

7020 POKE 60,2: POKE 61,16: POKE
     62, PEEK (4096): POKE 63, PEEK
     (4097): CALL -259
7030 GOTO 2
7100 INPUT "FILE NAME ",A$
7110 PRINT "BLOAD ";A$: GOTO 2
8000 REM
8001 REM  **********************
8002 REM   PRINT LINES
8003 REM  **********************
8010 X=X+1:T1= PEEK (X):B=1: GOSUB
     5000
8020 FOR T=1 TO T1-1: FOR LP=1 TO
     LEN: PRINT S$(P(LP),P(LP));
     : NEXT LP
8030 PRINT : NEXT T
8040 RETURN
9000 REM
9001 REM  ****************
9002 REM  INSTRUCTIONS
9003 REM  ***************:
```

PROGRAM 2 (Continued)

```
9010 CALL -936: PRINT "MCCALLS CAREFR
     EE PATTERNS #6066"
9020 VTAB 3: PRINT "   THIS PATTERN I
     S MADE TO FIT BODY     MEASUREME
     NTS, WITH EXTRA EASE FOR COM-  F
     ORT AND STYLE.": PRINT
9030 PRINT "   ADJUST PIECES BEFORE P
     LACING ON      FABRIC.": PRINT
9040 PRINT "   TO LENGTHEN : SEE MCCA
     LL'S HOW TO FITBOOK."
9050 PRINT : PRINT "   BEFORE CUTTING
      PLACE ALL PIECES ON   FABRIC.
     SEE CUTTING LAYOUT.": PRINT
     "PATTERN #1, 3 AND 5 ARE PLACED
     ALONG  "
9060 PRINT "FOLDED SIDE OF THE FABRIC
      SO THE PATTERNPIECES WILL BE TW
     ICE THE SIZE OF THE": PRINT
     "PAPER PATTERN"
9070 VTAB 20: PRINT " TYPE Y TO CONTI
     NUE";: INPUT D$
9100 CALL -936: PRINT "MCCALL'S CAREF
     REE PATTERNS #6066"
9110 VTAB 3: PRINT "   PATTERN 1 AND
     5 ARE CREATED USING    THE SAME
     CASSETTE DATA."
9120 PRINT : PRINT "   PATTERNS 2 AND
      3 ARE THE FRONT YOKES.PATTERN 3
      IS USED FOR FINER FABRICS"
9130 PRINT : PRINT "   ALL PIECES HAV
     E A 1/4 TO 1/2 INCH    FOLD OVER
      MATERAL.  DOTTED LINES SIGNAL P
     OSITION FOR THE FOLD"
9140 PRINT : PRINT "FRONT YOKE - FINI
     SH UPPER EDGE OF YOKE  #3 WITH S
     TITCHING, TURN UNDER 1/4 INCH  O
     F FRONT YOKE TO THE INSIDE"
9150 PRINT "ATTACH EATHER YOKE TO THE
      FRONT OF      DRESS (PATTERN #1
     )"
9160 VTAB 20: PRINT "SEE DIAGRAMS IN
     INTERFACE AGE FOR ANY   PROBLEMS
     "
9170 INPUT "HIT RETURN",D$: CALL
     -936: GOTO 10
9999 END
10000 REM  AUTOMATED DRESS PATTERN
10001 REM  CREATED FOR INTERFACE AGE
10002 REM  BY WM. V. SMITH:SOFTAPE
     WM. DEPEW : SOFTAPE
```

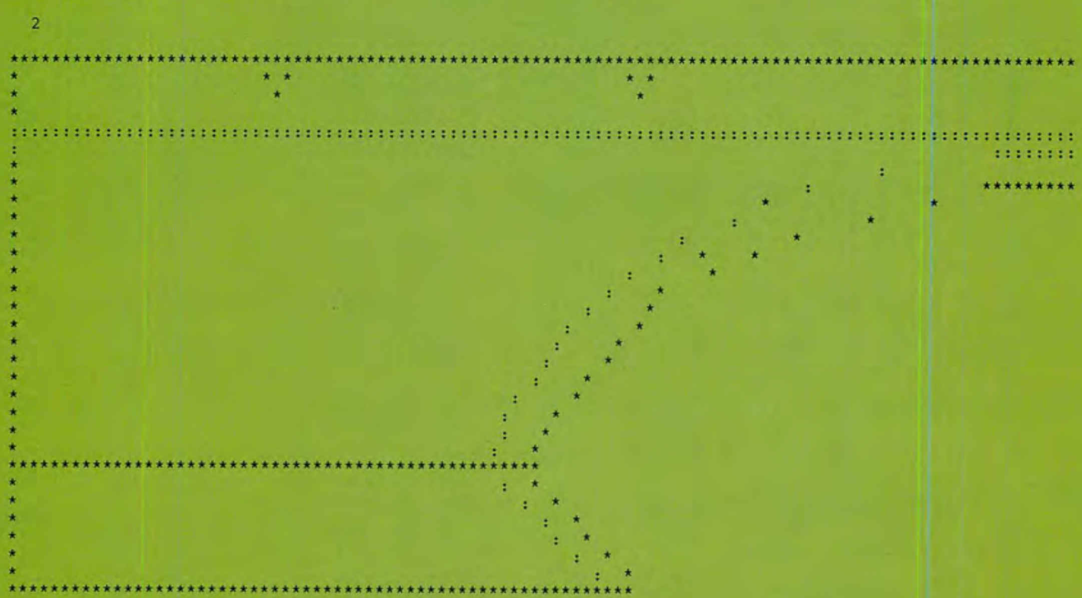


Figure 1.

```
>RUN
MCCALLS DRESS PATTERN #6066
FOR USE ON ANY 132 COLUMN PRINTER
1 - LOAD A PATTERN FROM CASSETTE
2 - PRINT PATTERN ON PRINTER
3 - INSTRUCTIONS FOR DRESS
YOUR SELECTION # ?
```

Figure 2.


INTERFACE AGE ™
MAGAZINE
Presents
THE FLOPPY ROM™
PROGRAM SHEET
33 1/3 RPM
MONAURAL
PLACE COIN HERE IF SOUNDSHEET SLIPS
Side 1
THE AUTOMATED DRESS PATTERN
By B. Smith, B. DePew and P. Essick
In APPLE Basic
Page 80a
72178A
INTERFACE AGE Magazine Sept. 1978, Vol. 3, Issue 9 1978 COPYRIGHT © ALL RIGHTS RESERVED
MFD. IN U.S.A. BY EVA-TONE® DEERFIELD, ILL.
SOUNDSHEETS


INTERFACE AGE ™
MAGAZINE
Presents
THE FLOPPY ROM™
PROGRAM SHEET
33 1/3 RPM
MONAURAL
PLACE COIN HERE IF SOUNDSHEET SLIPS
Side 2
A PROGRAM FOR WRITING LETTERS
By John MacDougall
In the IAPS™ format
Page 80b
72178B
INTERFACE AGE Magazine... Sept. 1978, Vol. 3, Issue 9 1978 COPYRIGHT © ALL RIGHTS RESERVED
MFD. IN U.S.A. BY EVA-TONE® DEERFIELD, ILL.
SOUNDSHEETS

PROGRAM LISTING 3

```
1000- C9 10 A0 35 7A F0 35 AB
1008- F0 76 AC F0 7A AB A0 06
1010- 17 F0 06 AB F0 17 AB A0
1018- 1D 2F AC A0 09 14 F0 21
1020- AC F0 26 AC F0 2B AC A0
1028- 35 7A F0 09 AC F0 14 AC
1030- F0 3F AC F0 44 AC F0 46
1038- AC F0 76 AC FA 01 A0 1D
1040- 2F FA 3C 96 0A 1D 0F 20
1048- 0F 18 FF 96 22 10 19 1F
1050- 1C FF 96 50 02 02 02 01
1058- 0F 13 11 12 1E 01 02 02
1060- 02 FF FA 3C 96 0A 1D 0F
1068- 20 0F 18 FF 96 22 10 19
1070- 1F 1C FF 96 50 02 02 02
1078- 01 0F 13 11 12 1E 01 02
1080- 02 02 FF FA 30 F0 21 AA
1088- F0 26 AA F0 2B AA A0 21
1090- 2B FA 02 F0 1D AA F0 2F
1098- AA A0 1D 2F FA 03 F0 06
10A0- AA F0 09 AA F0 14 AA F0
10A8- 17 AA A0 06 17 FA 04 F0
10B0- 3F AA F0 44 AA F0 46 AA
10B8- A0 35 7A FA 03 F0 35 AA
10C0- F0 76 AA F0 7A AA A0 35
10C8- 7A 76
*
```

PROGRAM LISTING 4

```
1000- 65 10 A0 11 76 F0 11 AB
1008- F0 76 AB 29 2B 4C 4E 2A
1010- 4D 11 AC A0 11 76 11 A0
1018- 6F 76 64 5D AB A0 6E 76
1020- F0 76 AA 59 AB 69 AC 56
1028- AB 63 AC 51 AB 5C AC 4F
1030- AB 53 58 AC 4C AB 54 AC
1038- 4A AB 4F AC 48 AB 4E AC
1040- 46 AB 4D AC 45 AB 4B AC
1048- 44 AB 4A AC 43 AB 48 AC
1050- 41 AB 47 AC 40 AB 45 AC
1058- 40 AB 44 AC 3F AB 43 A0
1060- 11 43 F0 11 AA 0A
*
```

PROGRAM LISTING 5

```
1000- D0 10 A0 06 17 A0 1D 2F
1008- A0 35 7A F0 06 AB F0 09
1010- AC F0 14 AC F0 17 AB F0
1018- 1D AB F0 21 AC F0 26 AC
1020- F0 2B AC F0 2F AB F0 35
1028- AB F0 3F AC F0 44 AC F0
1030- 46 AC F0 76 AC F0 7A AB
1038- FA 03 AC A0 09 14 A0 1D
1040- 2F A0 35 7A FA 78 96 0A
1048- 1D 0F 20 0F 18 FF 96 22
1050- 10 19 1F 1C FF 96 50 0F
1058- 13 11 12 1E 02 02 FF 96
1060- 50 01 FF 96 50 17 0D 0D
1068- 0B 16 16 1D 01 0E 1C 0F
1070- 1D 1D 01 1A 0B 1E 1E 0F
1078- 1C 18 1D FF 06 96 50 13
1080- 18 1E 0F 1C 10 0B 0D 0F
1088- 01 0B 11 0F FF FA 2D F0
1090- 21 AA F0 26 AA F0 2B AA
1098- FA 03 F0 1D AA F0 2F AA
10A0- A0 1D 2F FA 03 F0 06 AA
10A8- F0 09 AA F0 14 AA F0 17
10B0- AA AB A0 06 17 FA 0C A0
10B8- 35 7A FA 03 F0 35 AA F0
10C0- 3F AA F0 44 AA F0 46 AA
10C8- F0 76 AA F0 7A AA FA 03
10D0- 77
*
```

PROGRAM LISTING 6

```
1000- B6 12 F0 01 AB F0 82 AB
1008- F0 33 AE A0 01 82 19 1B
1010- 50 52 1A 51 01 AC A0 01
1018- 82 F0 7D AC FA 05 F0 7D
1020- AA F0 82 AA F0 7C AC F0
1028- 81 AB F0 81 AB 96 35 0D
1030- 1F 1E 01 0B 18 0E 01 0B
1038- 0E 0E 01 1E 12 1C 0F 0F
1040- 01 13 18 0D 12 0F 1D 02
1048- FF FA 05 F0 81 AA F0 7C
1050- AA F0 7B AC F0 80 AB FA
1058- 05 F0 7B AA F0 80 AA F0
1060- 7A AC F0 7F AB FA 05 F0
1068- 7A AA F0 7F AA F0 79 AC
1070- F0 7E AB 96 41 17 0D 0D
1078- 0B 16 16 1D 01 0E 1C 0F
1080- 1D 1D 01 1A 0B 1E 1E 0F
1088- 1C 18 1D FF 01 01 96 41
1090- 10 19 1C 01 13 18 1E 0F
1098- 1C 10 0B 0D 0F 01 0B 11
10A0- 0F 28 FF FA 02 F0 79 AA
10A8- F0 7E AA F0 79 AC F0 7E
10B0- AB FA 05 F0 79 AA F0 7E
10B8- AA F0 78 AC F0 7D AB FA
10C0- 05 F0 78 AA F0 7D AA F0
10C8- 77 AC F0 7C AB FA 05 F0
10D0- 77 AA F0 7C AA F0 76 AC
10D8- F0 7B AB FA 05 F0 76 AA
10E0- F0 7B AA F0 75 AC F0 7A
10E8- AB FA 05 F0 75 AA F0 7A
10F0- AA F0 74 AC F0 79 AB FA
10F8- 05 F0 74 AA F0 79 AA F0
1100- 73 AC F0 78 AB FA 05 F0
1108- 73 AA F0 78 AA F0 72 AC
1110- F0 77 AB FA 05 F0 72 AA
1118- F0 77 AA F0 71 AC F0 76
1120- AB FA 05 F0 71 AA F0 76
1128- AA F0 70 AC F0 75 AB FA
1130- 05 F0 70 AA F0 75 AA F0
1138- 6F AC F0 74 AB FA 05 F0
1140- 6F AA F0 74 AA F0 6E AC
1148- F0 73 AB FA 05 F0 6E AA
1150- F0 73 AA F0 6D AC F0 72
1158- AB FA 05 F0 6D AA F0 72
1160- AA F0 6C AC F0 71 AB FA
1168- 05 F0 6C AA F0 71 AA F0
1170- 6B AC F0 70 AB FA 05 F0
1178- 6B AA F0 70 AA F0 6A AC
1180- F0 6F AB FA 05 F0 6A AA
1188- F0 6F AA F0 69 AC F0 6E
1190- AB FA 05 F0 69 AA F0 6E
1198- AA F0 68 AC F0 6D AB FA
11A0- 05 F0 68 AA F0 6D AA F0
11A8- 67 AC F0 6C AB FA 05 F0
11B0- 67 AA F0 6C AA F0 66 AC
11B8- F0 6B AB FA 05 F0 66 AA
11C0- F0 6B AA F0 65 AC F0 6A
11C8- AB FA 05 F0 65 AA F0 6A
11D0- AA F0 64 AC F0 69 AB FA
11D8- 05 F0 64 AA F0 69 AA F0
11E0- 63 AC F0 68 AB FA 05 F0
11E8- 63 AA F0 68 AA F0 62 AC
11F0- F0 67 AB FA 05 F0 62 AA
11F8- F0 67 AA F0 61 AC F0 66
1200- AB FA 05 F0 61 AA F0 66
1208- AA F0 60 AC F0 65 AB FA
1210- 05 F0 60 AA F0 65 AA F0
1218- 5F AC F0 64 AB FA 05 F0
1220- 5F AA F0 64 AA F0 5E AC
1228- F0 63 AB FA 05 F0 5E AA
1230- F0 63 AA F0 5D AC F0 62
1238- AB FA 05 F0 5D AA F0 62
1240- AA F0 5C AC F0 61 AB FA
1248- 05 F0 5C AA F0 61 AA F0
1250- 5B AC F0 60 AB FA 05 F0
1258- 5B AA F0 60 AA F0 5A AC
1260- F0 5F AB FA 05 F0 5A AA
1268- F0 5F AA F0 59 AC F0 5E
1270- AB FA 05 F0 59 AA F0 5E
1278- AA F0 58 AC F0 5D AB FA
1280- 05 F0 58 AA F0 5D AA 96
1288- 35 0D 1F 1E 01 0B 18 0E
1290- 01 0B 0E 0E 01 2C 01 13
1298- 18 0D 12 0F 1D FF A0 01
12A0- 5D AB F0 5B AB FA 04 F0
12A8- 5B AA A0 01 5B F0 01 AA
12B0- F0 33 AA F0 5B AA 00
*
```

ARE YOU READY FOR TELEPHONE NETWORKING?

By Tim Ryan
University Data Systems

Would you like to be able to connect your home computer directly to your telephone and become the member of a computer network? Until only recently, connecting any device to your phone electrically has been a legal problem unless it was connected via a telephone company supplied coupler. This can now be done with other non-telephone company equipment, but the telco must be informed of the connection and the equipment must be approved either by a federal registration or grandfathering program or on a state by state basis through a certification program. This new breakthrough is the first step to practical hobby networking.

THE WAY IT USED TO BE

The capability to attach anything to your telephone, no matter how harmless, has been jealously guarded by the telco as their monopolistic prerogative. This capability has only been won slowly over a period of decades through a series of court decisions.

The early fifties saw the introduction of a simple mechanical device that fits on the mouthpiece of a telephone called the Hush-A-Phone. The Hush-A-Phone is used to reduce the background noise that is heard by the person being called. Bell attempted to stop the use of these devices. In a 1957 landmark decision the court ordered the FCC to have the AT&T tariff changed to allow the use of the Hush-A-Phone. The FCC responded with a ruling that AT&T could not prevent the use of any "device which does not injure employees, facilities or the public in its use of the services, or impair the operation of the telephone system."

Many companies took this broad language to mean that they would be able to connect a whole host of new devices to the telephone. A Texas businessman, Thomas Carter, introduced the Carterfone in 1959. It allowed the creation of a radiotelephone link by placing the telephone handset in a cradle on the Carterfone. There was no electrical connection to the telephone, only an acoustic connection. The telephone company forced Carter out of business in 1966 by warning people who were using and selling Carterfones that their phones would be disconnected unless they stopped using the device.

Carter brought an antitrust suit which ultimately resulted in a court victory for Carter and a 1968 FCC declaration that "the provisions prohibiting the use of customer provided interconnection devices should accordingly be stricken [from the tariff]." The telephone company refused to honor this even broader language and announced it would only allow the unrestricted interconnection of acoustic or inductively coupled devices like the Carterfone.

The only way that Bell companies would recognize the electrical connection of subscriber owned equipment during this period was if the subscriber made use of a telco supplied coupler. These couplers typically added several dollars monthly for each line to a phone bill and were required even if the device you wanted to connect was the same make and model as a device marketed by the phone company for use without a coupler. This form of rate gouging was tolerated by state and federal officials for years. If you purchased a device to be connected to the telephone, the manufacturer dutifully informed you that an additional monthly charge may be involved. A manufacturer also informed you what model coupler to use if asked.

If you intended to make a device yourself to connect to your phone line electrically, you would quickly run into a blank wall. The telephone company refused to give out the technical specifications of its couplers to the general public.

THE WAY IT IS

This situation has changed recently. A broad line of low priced telephone equipment has been introduced by private vendors using solid state technology. This equipment has so many innovative features that are not available from Bell that the interconnection industry has flourished. The resulting pressure caused the FCC and the state of California to start programs to verify the harmlessness of this equipment by independent engineers. In the meantime, products that have been historically in use and safe all these years are temporarily granted the status of being "grandfathered" until they can be officially processed. Bell tried to prevent the success of these programs in court and lost.

There are two types of programs: a federal registration program and a state certification program. Both processes revolve around an important distinction in the legal concepts of a tariff and an FCC rule or a state equivalent of such a rule. A tariff is a proposal drawn up by a telephone company which proposes to offer a service or product to the public for a given cost. Since the telco has a monopoly, the terms and cost of the offer have to be approved by a state or federal regulating commission to verify their reasonableness. If the telco does not propose a tariff, the service will not be legally available. A commission cannot propose a tariff and force the telco to offer it. A commission may issue an order or ruling which specifies that certain procedures must be followed in the granting of telephone service and may set quality standards to be sure the subscriber is treated fairly and gets good service. A commission may, on rare occasions, accomplish results with a ruling that are equivalent to proposing a tariff. It may fine the telco if the order is not obeyed.

FEDERAL REGISTRATION

The federal program is handled by the FCC and is by far the more encompassing program. The program was created by Part 68 of the FCC Rules and Regulations and provides for the registration of devices to be directly connected to the telephone network. The rules create 28 different classes of equipment for which applications will be accepted, including a catchall "other" class. Once a grantee has completed the details of the registration process, he is assigned a 14 character registration code for the device submitted. This code can be broken down to give more specific information about the device.

Registration is mandatory both for equipment sup-

plied by private vendors and by a telephone company. This unique concept of fairness ends the double standard by which telcos have asserted that they were the only source that was technically sophisticated enough to judge the safety of telephone equipment. This has created a problem of how to handle existing equipment.

AAABBB-12345-AL-T

- R,T,E, or N tells the type of signalling compatibility
- Tells the type of equipment (e.g., Alarms)
- Unique part of registration number
- Code for the Manufacturer
- Code for the Grantee

AL — Alarm Systems	LP — Line Privacy Unit
AM — Amplifiers, Telephone	MA — Multipurpose Ancillary
AN — Answering Sets	MO — Monitoring Equipment
BR — Bridges, Conferencing	MT — Multipurpose Telephone
CD — Call Distributors	OT — Other
CI — Call Diverters	PA — Public Address
DE — Decoder (Descrambler)	PB — Private Branch Exchange
DI — Dialer, Automatic	PC — Protective Circuitry
DM — Data Modem	RD — Recorder, Dialed Number
DT — Data Comm. Terminal	RE — Recorder, Elapsed Time
EN — Encoder (Scrambler)	RT — Recorder, Traffic
FA — Facsimile Equipment	TC — Telephone, Coin
IN — Intercom	TE — Telephone
KT — Key Telephone System	TR — Toll Restriction

Federal registration codes are 14 characters long. The last character shows equipment compatibility: T for Touch Tone, R for Dial phones, E for either, N for neither.

Table 1.

A special temporary program called grandfathering has been created. Under this program products that have been installed before August 1, 1979 and which have a safety record that merits them being put on a grandfather list are allowed to be connected to the telephone line with no protective devices. This program has been extended in the past and may very well be extended again in the future. A grandfathered device may remain connected for life.

STATE CERTIFICATION

State certification, a less common form of program, is conducted under state supervision. One form of rationality for this is that there has been concern that proposed legislation such as the "Bell Bill" may try to limit the ability of the FCC in many ways, leaving a vendor obligated to go through separate legal procedures in every state that he wishes to operate. Bell has been quite unhappy with the open minded encouragement of competition brought on by the FCC and has reportedly spent in excess of one million dollars to lobby for the limitation of the powers of the FCC. If a state establishes a program of its own, it may help protect its residents against the uncertain future of unforeseen federal problems.

An example of a state certification process is the one administered by the California Public Utilities Commission. It was established after hearings resulting from numerous complaints of vendors and the public. The result was General Order 138 which details the conditions under which equipment Californians own may be directly connected to the telephone line. The order includes definitions of terms, lays out the legal and technical process of certification and requires that lists of certified devices be available for public inspection at telco main offices.

The certification process starts when a manufacturer gives a model of an item to be certified to an independent registered engineer. The engineer verifies that it meets the electrical specifications detailed in General Order 138 and informs the PUC if it does. The commission then gives the device a four digit registration number and makes the registration effective in thirty days unless protested by the phone company.

All such items sold are labeled with the manufacturer's name, model number, PUC registration number, and a ring equivalence number (REN). When you buy and install the product, it is up to you to supply this information to the telephone company. If you don't and the unauthorized connection is discovered, they will get in touch with you and ask for the information. If you don't cooperate, they can disconnect your service until you sign an agreement saying that the device has been disconnected.

WHAT TO CONNECT

This new freedom of direct connection leaves the details up to the manufacturers. Only if a manufacturer seeks to have his device inspected by an independent registered engineer and processed by a commission will he obtain approval for his product. No hobby computer firms have taken this step forward. This leaves you with only one solution; obtain a protective connecting arrangement (PCA). This is a device that will allow you to connect anything you desire to your telephone! They are available from the phone company for a monthly charge or from private companies. Since they may be fairly expensive at this time, it may be desirable to arrange for a group buy through your local computer club or hobby computer dealer. At one time Phonemate manufactured a PCA under license from Bell which sold for $30, but they discontinued manufacturing it when registration eliminated a need for PCA's with answering machines.

	Grandfathered	Registered	Certified
Protective Couplers	80	95	0
Data Modems	>500	19	0
Data Access Arrangements	44	0	5

Table 2.

OTHER CONNECTION IDEAS

Two other common forms of connection for transmitting data are acoustic coupling (e.g. Pennywhistle Modem or second hand modem) and the data access arrangement (DAA). Acoustic coupling involved setting the handset of the telephone into a pair of rubber cups so that sound can pass back and forth between the cups and the handset. If the telephone is an unusual model or has a marginally acceptable sensitivity to sound such as a weak earpiece or mouthpiece, you may have difficulty getting good results. An acoustic connection will always have certain distortions associated with its use that can

GLOSSARY OF TERMS

Acoustic connection — Coupling between the customer provided equipment and telco equipment that involves no direct electrical connection.

Ancillary equipment — Additional or auxiliary equipment that improves the value of telephone service. This category includes such items as answering machines, home computers, modems, automatic dialers, conferencing devices, call diverters, call usage restrictors and call restrictors. This does not include the main station telephone, extension telephones or private branch exchanges (PBX).

Attested equipment — Nonpowered plug-in headset or conferencing equipment that does not require a PCA.

Central switching office (CO) — The local switch room where all subscribers with the same three digit prefix are interconnected with subscribers with different prefixes via central office and toll office trunks.

Certification — The state procedure for inspecting and approving equipment to be directly attached to a telephone line.

Conferencing equipment — Equipment which interconnects three or more telephones and permits all parties to talk simultaneously.

Customer provided equipment (CPE) — Any device provided by the telephone subscriber which is to be connected to telco supplied equipment or a telephone line.

Data access arrangement (DAA) — A modem that can automatically answer a telephone line with a data tone, process a simple data handshake sequence and allow the transfer of data from the telephone line to a direct current signal. (e.g. Bell Model 103).

Electronic switching system (ESS) — A modern computer controlled type of switching equipment that is used in central offices to switch telephone calls. This is a Bell system product that has several custom calling features not available on earlier vintage equipment such as step by step or crossbar.

Grandfathering — Part of the federal registration program that allows a period of grace during which certain existing equipment may be connected without a registration number. The item must appear on the grandfathered equipment list and be installed before July 1, 1979 unless this deadline is extended again.

Inductive connection — Coupling between the customer provided equipment and telco equipment that involves no direct electrical connection but which transfers a signal by use of a magnetic field (e.g., a telephone pickup coil).

Line — The circuit between the subscribers location and the telephone company central switching office (CO).

Main station — If you only have one phone on your line, it is called the main station. Additional phones are called extensions.

Modem — A device that interconverts audible signals that can allow data to be sent via phone line and direct current signals themselves. Direct current signals can be understood by a terminal or a terminal interface to a computer. The most common signal formats are EIA RS232, 20 ma current loop, and IEEE 488 instrumentation bus.

Prefix — The first three digits of a phone number (not the area code) which uniquely identifies the central switching office that serves the line. All residential phones with the same prefix are served by the same type of switching equipment. Several different prefixes may be located in the same central office but each may have a different type of switching equipment.

Private Branch Exchange (PBX) — A subscriber installation that includes a switchboard. An automatic PBX is called a PABX.

Protective connecting arrangement (PCA) — A coupler or connecting arrangement which allows CPE to be connected directly to the telephone line. Its purpose is to prevent any harmful or undesirable voltages or signals to damage telco equipment. This device may be supplied by the telco or may be certified, registered, or grandfathered.

Registration — The federal procedure for inspecting and approving equipment to be directly attached to a telephone line.

Ringer equivalence number (REN) — A measure of the electrical load on the subscriber's line. Each telephone with a ringer (bell) counts as one REN unit. The REN will be followed by a suffix letter. Only CPE with the letter "A" or "B" will be accepted for use as CPE that may be directly connected to a line. Other letters designate equipment that is to be used with party lines.

Tariff — A formal description of the services, products, rates and policies that a telephone company can offer by law. It is proposed by a telephone company and approved by a utilities commission. Each telephone company in a state will have its own separate tariff. There are state and federal tariffs. They are available for public inspection at selected business offices.

Vendor — The source from which a customer obtains privately manufactured non-telco equipment.

be eliminated by a direct connection. The data access arrangement is a sophisticated modem that you may be able to obtain used. Many DAA's have been grandfathered, so they may be connected directy to the phone line without a PCA.

HOW TO TALK TO YOUR TELEPHONE BUSINESS OFFICE

The first rule of thumb is to become familiar with the terms you will be using so that you will be able to understand and be understood by the business office representative. Write down a series of questions using these terms so that if your conversation becomes sidetracked, you will not forget to ask about specific points. Make sure you write down all the numbers from the device that you will be talking about so that they will be handy. Remember, the telephone company wants to know about all devices that are attached, even if they are only acoustically or inductively coupled. These devices do not have to be on a registered, grandfathered or certified list. (Telephone pickup coils are illegal if they are used to tape both sides of a conversation unless a beep tone is present or all parties to the conversation are notified verbally that they are being recorded.)

Call the business office rather than visiting it in person, unless you have to look at the tariffs before your questions are asked. Ask specifically to talk to a representative about the installation of customer provided equipment. When this person answers, write down his or her name for future reference. Often there is a representative that has been specially trained to handle the details of CPE inquiries, and this person may be reached most directly by phone rather than by a long wait.

If you do not know which program your device might qualify under, be sure to mention each program (certification, registration, or grandfathering) by name and ask specifically whether the device qualifies for each if you don't know. Some telco locations and employees actively resent the existence of these programs and have been told not to discuss them unless the customer specifically mentions them.

Go out of your way to be courteous and polite to the representative; they can make life a lot harder for you than you can for them. If things still do not seem to be going well, do not hesitate to ask to talk to a supervisor that will be more knowledgeable. As a last resort, be aware that an office is rated by the number of complaints it causes to the utilities commission. Most employees will be more helpful if you mention that you may have to contact the commission and complain. If you find reason to complain, ask the commission about what the tariff really says and what alternatives you have.

A business office representative will not ordinarily read from the tariff when making decisions, but will be using a rewritten version called the Commercial Practice (CP) or the Customer Service Reference Guide (CSRG).

There are reasons to anticipate a certain amount of trouble dealing with the business office. There is very little precedent for individuals attaching a computer to a home telephone, and the representative may insist that you purchase business service instead. Many representatives don't know that such things as hobby computers exist. It might be more tactful to simply call and register a PCA, without specifying an immediate use for it if possible.

If there is a problem, a more productive approach is to have the president of a local hobby club call the business office and ask to be called by someone that handles inquiries from vendors of customer provided equipment. The president may then be able to speak on behalf of the members of the club and establish a helpful contact with the company to help smooth out problems at the business office level.

WHAT THE REPRESENTATIVE WILL ASK

After you have stated what program you will be registering your equipment under, the representative will want to know the details. The manufacturer, model, serial number and type of plug (probably four prong or modular) will always be requested. The representative will then request the registration or certification number on a reference list. If the device does qualify, other questions may be asked. If you have more than one line, the representative will ask what lines the CPE will be used with.

One question always asked is what the ringer equivalence number (REN) is. This number represents the number of bells (or ringers) load that will be added to the line when the equipment is installed. This is important because as you increase the load on the line, you affect the ability of the line to ring correctly. There is a maximum legal limit for the total number of ringers that you can have on a line. The total is obtained by adding up the number of phones with ringers and the REN's of all CPE. The maximum allowable total will vary from one central switching office to another but will usually be four or five. It is best to calculate your ringer total before you call so you know it will not be exceeded. It might be

necessary for a repairman to charge you for a visit just to disconnect the yellow bell wire from one of your extension phones to reduce your ringer count by one.

There may be special restrictions in some areas preventing use of CPE on party lines, on lines with business key telephone systems or on lines that have coin telephone service. You would never want to use CPE on a party line if it could be misused in such a way that it would prevent another person from using their phone in an emergency.

There may also be extra charges that you do not anticipate. You may need to buy a plug adapter if the plug on your CPE does not match the jacks which are currently listed as being installed on your line. It is also important to note that charges for extension phones and touch tone service may have been split so that there is a charge for the hardware and for the service. If you have dial service which would allow you to use touch tone and you decided to get a non-telco touch tone phone to take advantage of this, the phone company would still charge you for touch tone service. The representative will know whether equipment is suitable for touch tone by the last letter of the federal registration code.

You may also discover that the monthly charge for an extension phone is not really one rate for the phone itself but is a recent "wiring" charge that applies regardless of whether you or the phone company owns the phone or device.

One problem that occurs with a grandfathered device is that there may be no model number, serial number or REN. A serial number is not absolutely required, and the representative will assume an REN of one if it is unknown. This leaves the model number as the only absolute necessity. If you were to say that you have a current model touch tone or dial Bell desk phone, the representative will probably refuse to tell you that it is a model 2500D touch tone or a model 500D dial phone, but will tell you to go to the vendor you bought it from to determine what the model number is.

So if you do not have a model number, you may want to consult a list of devices to see if there is one there that seems like yours. The nonappearance of a particular type of equipment on the list is not conclusive evidence that such equipment is not grandfathered. All official lists are constantly changing as more devices are added. If it is important to find out whether a specific device has been recently added to an official list, ask the business office representative to start a more detailed check. They can do this by calling a specialist at corporate headquarters.

TELEPHONE COMPANY SUPPLIED PCA

Part of the mystery of PCA's is why the telephone company offers such a large number of them rather than having a smaller number of general purpose couplers, thereby putting the burden of meeting network specifications on a CPE manufacturer like registration does. Instead they have such special purpose devices as automatic dialer PCA's that receive dial pulses from the CPE auto dialer and then regenerate them a second time to be sure that the pulses meet the signalling needs of its equipment. Table 3 shows a list of telco PCA's, also known as couplers.

If you don't specify which one you need, the representative will frequently try to have you get the most expensive one. A telco PCA is always ordered to be used with a stated device. It is never rented alone or for a general purpose application. Virtually any telco supplied PCA must be plugged into a power supply or a 110 volt wall outlet.

THE UNAUTHORIZED CONNECTION

It is best to let the telco know if you are going to hook something unusual up to the line. The worst that will happen, however, is that the company may discover something wrong while you are away on vacation, disconnect your line and reassign your number to someone else after you ignore their letters and calls. When you get back, you must pay extra money to reestablish service and give assurances that the device has been disconnected.

Type	KS Number	Suggested Use	Bell Cost/Mo (Cal)
C2ACP		Extension Phone	4.25
CAU	20445-L1	Alarm Devices	2.75
GTSAA		Auto Answer	2.60
GKT		Extension Phone	.50
RDL-L21	19522-L21	Auto Answer (timed)	3.50
RDL-L22	19522-L22	Auto Answer	3.50
RDM	19522-L21 2W 19522-L22 2W	Dictation Equipment	3.80
RDM-ZR	20721-L1	Dictation Equipment	4.40
RDY	20721-L2	Dictation Equipment	5.25
STC	20721-L1 20721-L10 20721-L14	Extension Phones	5.50
SU4	20445-L2	Alarm Devices	5.25
SU6	20445-L1 2W 20445-L2 2W	Two Way Voice	3.00
SU6AQ	20721-L1	Two Way Voice	5.25
SU7	20445-L1 RD	Auto Dialer	2.75
SU7QW	20721-L1	Auto Dialer	5.00
SU8	20445-L2	Two Way Voice	5.50

The SU6AQ coupler has been used with ham radio FM repeaters.

Table 3. Telco Supplied Couplers

The telco is concerned for several reasons. They want to assure the safety of their crafts people, the reliability of their equipment and the overall quality of service. Since the many CPE devices are also plugged into a 110 volt wall socket, they are concerned about the accidental leakage of hazardous voltages or of 60 cycle hum onto the line. High voltage is unsafe to telco employees and can severely damage the light gauge multiple pair cables used to carry your neighbors' calls. A hum or excessive volume level may also cause crosstalk problems between your lines and others.

It is forbidden to send a single frequency falling in the range 2450 to 2750 hertz or any combination of it which "exceeds the power present at the same time in the 800 to 2450 hertz band." If you ignore this consideration, you will find your toll calls will be sporatically terminated, and you may find telephone company security has tapped your line to see what you are doing.

There are also limits set for the allowable on hook and off hook load over wide environmental conditions as well as strict signalling standards if your CPE is equipped to dial or touch tone a number. These standards are needed because the telco is responsible for refunds if you do not reach the number you dialed. A CPE with network signalling capability must be able to dial or touch tone to within very close electrical tolerances. There are now several chips available that will perform these functions.

Unauthorized connections are commonly detected by installers, repair test clerks, business office representatives and systematic scans by crafts people. They are also reported by service observors who randomly tap lines and listen to your incoming and outgoing calls to check the "quality of service."

ONCE YOU ARE HOOKED UP

After you have a PCA or some type of modem hooked up, what can you do with it? There are three basic approaches you may want to explore depending on your area of interest and experience. You may use your hookup as a traditional modem for sending programs back and forth or timesharing — or as a traditional communications controller to implement voice and data switching on phone lines including conferencing, forwarding, auto answering or even electronic mail.

The most exciting prospects involve a hybrid of these two areas for the creation of local interactive communica-

tions networks. Such networks can be designed to serve the interest of hobbyists in general, such as the creation of program libraries, contests, databases of reference material and the ability to use the combined computing resources of several computers at different locations.

The only way these things can happen is for people to get their feet wet by experimenting with the circuits and software concepts needed to bring this about. Much of the work with simple inexpensive phone circuits has already been done by ham radio operators who have created repeaters with fancy telephone switching capabilities. Many of these folks have already purchased their own minicomputers and have several lines installed with couplers attached.

Aside from the lack of first hand experience, a second main impediment to practical progress in hobby networking is the diversity of the types of switching equipment currently in use in the United States. Bell operating companies which account for over 80% of the telephones in the U.S. have four major types of local switching equipment in use: step by step (SxS), #1 crossbar (1XB), #5 crossbar (5XB), and #1 electronic switching system (ESS). The speed, reliability, features, noise immunity, and general quality of service varies widely with ESS being the overall winner.

Fortunately, ESS is replacing SxS and 1XB as rapidly as the budget of the Bell System companies will allow. Independent companies have not been anywhere near as active as this and are not likely to be in the near future. In addition to their lack of funds, they have the additional disadvantage of having equipment from a wider variety of manufacturers including Automatic Electric, Stromberg Carlson, North Electric and ITT Kellogg.

WHY IS THE KIND OF EQUIPMENT SO IMPORTANT?

There are certain basic conditions concerning a telephone line that should be detectable by software if automated dialing and answering are desired. They are the ability to detect dial tone or ringing, the ability to determine if the called party has answered, and the ability to know when the called party has hung up.

To know when the answer and hangup occur can be very clearly determined by the handshake sequence of tones if the process does not involve the option of voice communication. As soon as voice is introduced, however, two common ambiguities arise. One is that when a called party answers, the voltage on your phone may reverse its polarity with certain types of equipment. The other ambiguity is that there may be no way to know whether the called party has hung up. In most areas the line will revert to dial tone after a few seconds, but this is not true for many independent phone companies. The only way to know for sure is to "flash" the switchhook of your phone momentarily to be sure if the connection is still alive.

These two limitations might cause unexpected circuit problems if a circuit developed by one person is given to someone else with a different prefix.

WHY IS ESS SO GOOD?

Neither of the problems mentioned above is likely to be found with Bell System equipment. ESS in particular is even more desirable because it is ordinarily offered in conjunction with several custom calling features: three way calling, call forwarding, call waiting and speed calling. Of these, three way calling is the most important for use with hobby networking because it can reduce or eliminate the need for high quality conferencing equipment. One person with three way calling can call two other people, and all three of them could have their computers linked together in a miniature network. The two called parties could then each call an additional person, extending the network even farther.

Since residential service is not billed on a measured basis for local calls, this network could continue for extended periods without attendance except by a master controller. The controller can allocate which members of the network will be communicating at one time. If inexpensive multiplexing chips become available, several CPUs could be talking simultaneously without the need for a timeshared use of the line.

If three people can subscribe to ESS three way calling or get two lines and attach a line tie, a conference of five is possible. Lines used for data should not have ESS call waiting.

Once software is established to control the protocol for this type of network, multiplayer interactive games become practical for CPUs which would otherwise be incompatible or impractical to move about.

A NOTE ABOUT VOICE CONFERENCING

Besides using your PCA for the transmission of data, it can also be used for the control of voice and the remote control of your telephone. One look at the list of FCC equipment types will give you plenty of ideas how you could use a home computer to act as a controller for telephone switching, dialing, answering, toll restricting, and touch tone to dial pulse conversion to mention a few. Consider the fancy things that are ordinarily only available on fancy electronic switchboards like giving callers special codes for auto-answer custom features, loudspeaker paging and hands free talking, inward dialing to specific extensions, distinctive ringing patterns, and multi-party conferencing. Almost anything described above that you could do if you were at your own phone could also be done remotely.

An important aspect of voice conferencing is maintaining the quality of the connection between the parties farthest from each other along the conferencing path. Each interconnection between one line and another introduces a loss which can only be minimized by a high quality conference bridge also known as a line tie.

This bridge is automatically present if the ESS three way calling feature is available. If not, a circuit will be necessary that will amplify the signal to maintain its volume. This is a problem because there are only two wires to make the connection between both parties, and input is coming from both directions. A simple line tie is no more than a pair of capacitors between the lines being joined, sometimes called a cheesebox. This will give an unacceptable loss of volume under most circumstances. The most acceptable solution is to find at least one person who is able to obtain ESS service and have this person be a central point in the network.

HOT STUFF

Of course if you really get hooked on these capabilities, you can establish two parallel nets, one for data and one for voice. Once concepts of hardware and software have been ironed out for each separate area, parallel connections can be established to take full advantage of both nets simultaneously. Board meetings of clubs complete with an instant hard copy of the minutes of a meeting could be a reality. Interactive contests involving many people at different locations could bring about a basic shift in the design of computer games with players than can still talk to each other. You would be able to tutor a group of friends by phone and CRT simultaneously on the fine points of a language or operating system that are not available on their systems. This would also be of value to educators working with small groups of handicapped people.☐

MICRO WORLD SEPTEMBER SPECIALS

North Star Horizon Kit

the applications computer

Here's the hot one! North Star's hi-performance Z-80 computer. Integrated floppy disk memory, extended BASIC, double the power of the 8080.

- Z-80 processor
- serial port
- 16K RAM memory
- disk drive
- add'l 16K memory, $349
- add'l disk drive, $349
- exclusive application software

$1349
(reg. $1599)

Call for low assembled prices.

$2095
reg. $2495

LA 180 DECprinter with Serial Interface

immediate delivery on the field-proven performer

180 cps has never been so affordable. For a limited time, MicroWorld lowers the price of Digital's versatile medium speed printer. Reliable technology and an extensive array of human engineering features make the LA 180 the smart choice for local or remote business applications.

- 180 characters per second printing
- tractor feed with switchable forms length control
- upper/lower case & stand • compressed print, 16.5 characters per inch

$1895

Texas Instruments Impact Printer

don't wait 240 days from TI — call MicroWorld for guaranteed scheduled delivery

TI's new 810 multi-copy impact printer. Prints up to 440 lines per minute because of its unique look-ahead bi-directional feature, controlled by an on-board microprocessor.

- 150 cps, 110 to 9600 baud switchable
- includes tractor feed
- RS232 serial interface

IP-125 Printer by Integral Data

$749
(reg. $799)

More specials from stock

Soroc IQ 120 Terminal	$ 895
TI-765 Bubble Terminal (with coupler)	2595
Hazeltine 1500 Terminal (ass'l'd.)	995
Centronics 779 Printer	1145
DEC writer	1495

MICRO WORLD™

1425 W. 12th Pl.
Tempe, AZ. 85281
602-894-1193

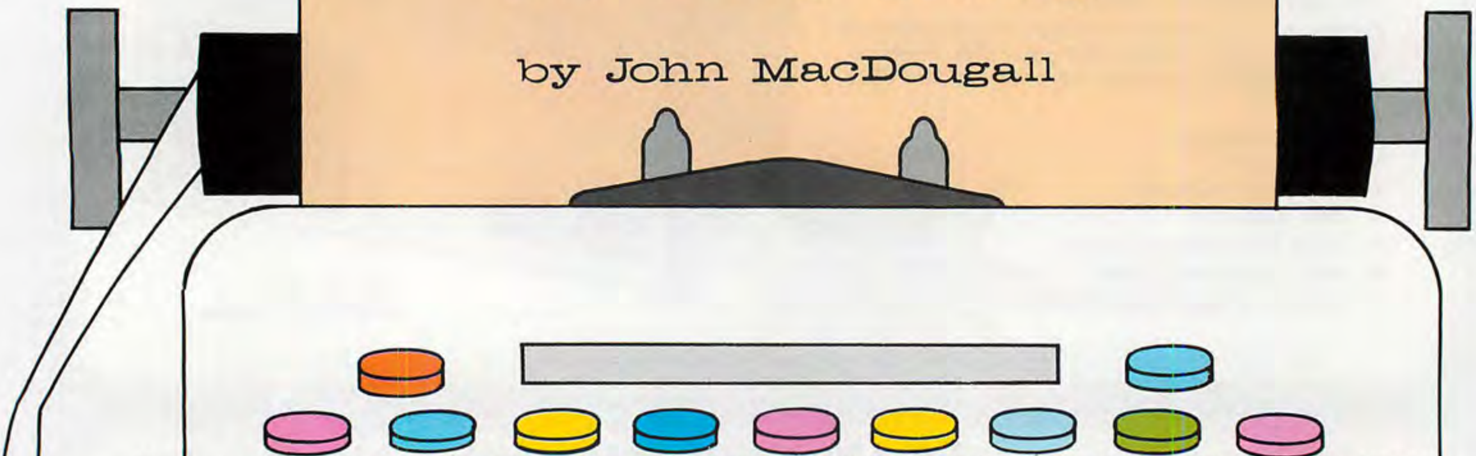
MicroWorld (formerly Byte Shop Mail Order) is a division of The Phoenix Group, Inc. Call or write for all your computer needs.

all prices plus shpg. & hdlg.

New Byte Shopper Guide Vol. III. $3.95 (includes $1.00 postage)

How to Write Form Letters That Look Like the Real Thing

by John MacDougall



How many times have you received a letter in the mail addressed just to you and obviously written, individually, on a typewriter, just for you? As irritating as this may be at times, when the letter is part of the "junk" mail avalanche, you will have to admit that there are times when you or your business or your club would like to do the same thing for a perfectly good cause. As you know, there is a particularly happy marriage between word processing and the microprocessor. If you would like to send out your own junk mail and have a reasonable hard copy device to make it look nice, then read on. This is how I was able to do it for one organization. Please note that the organization and addresses illustrated in the article are completely fictitious.

WHAT THE PROGRAM DOES

Although the program is sufficiently general that it can be easily adapted to any system, it is, nevertheless, configured about my system, and a brief description of the system is necessary to understand some of the software. My system consists of an IMSAI with a TDL Z-80 board and 20K of RAM. Since the text editor and monitor all operate out of PROM, the RAM space is fully available. My console is an OMRON CRT terminal, and the printer is a surplus DIABLO daisy wheel printer mechanism. Thus, the software is configured for a console that is separate from the hardcopy output. This should not pose too much of a problem if your console and output are the same except for the title and name in "oddball" letters where the operator first types the information on the console, and it then transfers it to the output (more on this later). I have a high speed tape reader and punch. Again, these should be no problem except that the reader must be controlled. This effectively rules out the use of batch readers such as cassette tapes.

Actually the RAM space requirements are about 3K for the average letter and the program to run it, so this can be performed out of a very minimal system provided that a good I/O device is on hand.

The program has a number of features that allow the operator considerable freedom in configuration of the final output. First of all, the letter may be typed fully automatically with no input from the operator other than loading the address tape and pushing the start button. However, sometimes there are addresses and personal titles which are so unusual that they could not be included in the program selection. These are handled in the "oddball" subroutine.

A letter which was typed in the fully automatic mode is illustrated in Figure 1. The address had been previously typed (with a lot of other addresses) in paper tape. This tape was mounted in the tape reader and the reader turned on. With the program accessed and the letterhead paper mounted in the typewriter, the letter "I" was typed on the console. The program then wrote the date and read and typed the first line of the address. While typing the first line, the program stored it in a buffer for later use. The program next read from the tape and typed the last few lines of the address up to a separator marker "~" (HEX 7E). Now comes the hardest part of the program — selection and typing of the title and surname of the addressee. First the program types "Dear" and then scans the first line buffer for all possible combinations of the common titles such as "Mr Mrs Miss Ms Dr". Combination titles such as "Mr & Mrs" are also found in a stepwise fashion and typed.

After finding and typing the titles, the program looks for the end of the first line in the buffer, then scans back for the start of the last word and assumes that is the surname. This is then typed, and the program continues on to finish the text of the letter.

Obviously, you have to be careful about the last word in the first line or the title will read something like "Dear Mr. & Mrs. Jr.". For addresses like this and for businesses or for occasions where you might like to type "Dear Joe", there is the oddball routine. A letter typed by this routine is shown in Figure 2. Here instead of typing the letter 'I', the operator typed the letter 'o' (for oddball), and then the computer finished by getting and typing the address from the tape. The program then typed "Name?" on the console and waited for the operator's input. The operator typed the salutation "Dear Joe(CR)", and the computer finished by typing the text of the letter as before. The program is arranged so that during the typing of the salutation, the text only appears on the console and the operator can make corrections by backspacing (the console echos the backspaced character) and retyping the correct information. When the carriage return is hit, the computer types the salutation and continues.

Figure 1. This is a full automatically typed letter commanded by the letter "l". The address tape must be in the reader and the reader turned on.

Feb. 20 1978

Mr Frank Williams
991 Garden Way
Los Altos CA 94022

Dear Mr. Williams

During the month of March we will be canvassing all of the club members regarding their interests and needs for the next year. Some of the questions which you should be thinking about are:
Should meetings be held once a month or every three months as now.
Should the dues be increased from $5 to $10?
How much equipment should the club purchase?
What group buys would you like to see?

Please be prepared to discuss the above questions and other topics with the club officer assigned to visit with you.

Meanwhile we hope that your past year has been interesting and successful and that the next year will be just as good.

regards

Roger Moal
President 1977-78

Feb. 20 1978

The Computer Toy Co.
11131 South Bostwick St.
San Jose CA 94068

Dear Joe

During the month of March we will be canvassing all of the club members regarding their interests and needs for the next year. Some of the questions which you should be thinking about are:
Should meetings be held once a month or every three months as now.
Should the dues be increased from $5 to $10?
How much equipment should the club purchase?
What group buys would you like to see?

Please be prepared to discuss the above questions and other topics with the club officer assigned to visit with you.

Meanwhile we hope that your past year has been interesting and successful and that the next year will be just as good.

regards

Roger Moal
President 1977-78

P.S. Many thanks for your support for our club activities during the past year. This letter is being sent to 50 of our members along with a note describing your store and the help we received from you.

Figure 2. This is an example of an oddball letter. After typing the address the computer asked (on the CRT) for the name. The operator typed 'Dear Joe (CR)' and the computer finished the letter. In this case a postscript was then added by the operator by typing the letter "p" on the console.

Any postscripts are added separately at the bottom of the letter at the option of the operator by typing the letter 'p'. This allows the selective addition of postscripts as shown in Figure 2. There are several other options that the program can perform. These allow the typing of envelopes, the listing of addresses, and the typing of text and postscripts for information purposes. All of the commands and options are listed in Table I and illustrated in the appropriate figures.

Table I. List of Functions in the Program

A	The contents of the address tape are printed on the list device single spaced and single line per address. A line length of 80 characters is assumed. Otherwise the program automatically delivers a CR and LF.
B	This is the same as "A" except that the addresses are double spaced. Examples of the commands "A" and "B" are shown in Figure 3.
E	Commands the printing of addresses in line by line format suitable for typing on an envelope. The addresses are read directly from the tape. Successive applications of the command "E" are shown in Figure 4.
L	This command tells the program to type the full letter automatically as described in the text and shown in Figure 1.
M	In my system this is used to inset the left margin for certain letters.
O	This is the command for the oddball letters described above and illustrated in Figure 2.
P	Commands the typing of the postscript as shown in Figure 2.
S	This very useful command allows skipping an address. At each command the tape is read and the first line of the address is echoed on the console so that one or several addresses may be skipped as desired.
T	The command "T" is used to type the text of the letter either for reference or to make extra copies for canvassers. Use of this command is shown in Figure 5.

Note: the program accepts either upper or lower case characters as commands. Upper case is shown here for clarity.

```
The Computer Toy Co.; 11131 South Bostwick St.; San Jose     CA 94068;
Bill's Dream Shop; 8024 Binary Ave; Sunnyglen     CA 94094; Attn  Mr. W. George;
Mr Frank Williams; 991  Garden Way; Los Altos    CA 94022;
Miss Nancy MacDoo; 30 Sunset Lane; Los Altos   CA 94022;
Mrs Jane Sonner; 432 Sunrise Court; Los Altos   CA 94022;
Dr & Mrs George Brunig; 330 E. Jane St; Mountain View    CA 94045;



The Computer Toy Co.; 11131 South Bostwick St.; San Jose     CA 94068;

Bill's Dream Shop; 8024 Binary Ave; Sunnyglen     CA 94094; Attn  Mr. W. George;

Mr Frank Williams; 991  Garden Way; Los Altos    CA 94022;

Miss Nancy MacDoo; 30 Sunset Lane; Los Altos   CA 94022;

Mrs Jane Sonner; 432 Sunrise Court; Los Altos   CA 94022;

Dr & Mrs George Brunig; 330 E. Jane St; Mountain View    CA 94045;
```

Figure 3. The upper address list is a single spaced and single line presentation of the address tape given by the command "a". The lower address list is a double spaced equivalent of the above and is commanded by pushing the letter "b" on the console. In both examples the tape must be positioned at the start in the reader and the reader turned on.

```
The Computer Toy Co.
11131 South Bostwick St.
San Jose     CA 94068


Bill's Dream Shop
8024 Binary Ave
Sunnyglen     CA 94094
Attn  Mr. W. George


Mr Frank Williams
991  Garden Way
Los Altos    CA 94022


Miss Nancy MacDoo
30 Sunset Lane
Los Altos   CA 94022


Mrs Jane Sonner
432 Sunrise Court
Los Altos   CA 94022


Dr & Mrs George Brunig
330 E. Jane St
Mountain View     CA 94045
```

Figure 4. This illustrates successive commands on the letter "e" (for envelope) and shows how the tape addresses appear on envelopes.

```
        During the month of March we will be canvassing all of the club
members regarding their interests and needs for the next year.
Some of the questions which you should be thinking about are:
      Should meetings be held once a month or every three months as now.
      Should the dues be increased from $5 to $10?
      How much equipment should the club purchase?
      What group buys would you like to see?

        Please be prepared to discuss the above questions and other topics
with the club officer assigned to visit with you.

        Meanwhile  we hope that your past year has been interesting
and successful and that the next year will be just as good.


regards


Roger Moal
President 1977-78
```

Figure 5. Depressing the letter "t" on the console commands the program to print only the text of the letter. Note that the date is missing from this printing since it is imbedded in the program.

PREPARING TO RUN THE PROGRAM

Some preparation is required before the program can be run. The first thing is to prepare the address tape. I do this on my text editor. Each address is typed in the exact manner in which it is to appear with two exceptions. First, compound titles must be separated by '&' rather than 'and'. Second, each address is separated from the next by the '~' symbol. If you don't have that symbol (it is 7E in HEX), substitute some other symbol in the program and the address list. The format of the address tape is important for later recognition by the program. A literal typing of a tape is presented in Figure 6. This is the way it appears on the CRT during editing. I do my address tapes with about 20 addresses per tape for convenience, but there is no program limit to the length of the tape.

```
The Computer Toy Co.
11131 South Bostwick St.
San Jose     CA 94068
-

Bill's Dream Shop
8024 Binary Ave
Sunnyglen    CA 94094
Attn  Mr. W. George
-

Mr Frank Williams
991  Garden Way
Los Altos   CA 94022
-

Miss Nancy MacDoo
30 Sunset Lane
Los Altos   CA 94022
-

Mrs Jane Sonner
432 Sunrise Court
Los Altos   CA 94022
-

Dr & Mrs George Brunig
330 E. Jane St
Mountain View    CA 94045
-
```

Figure 6. This shows the way that the address tape is constructed. Note the '~' sign used as an address separator. NOte also that compound titles are joined with '&' rather than 'and'.

In preparing the address tape, I find it convenient to separate all of the 'oddball' addresses and do them in a later tape. This makes the production flow smoother when it comes to typing the letters. I also find it best to list the addresses using the 'A' command for checking and to follow during the letter typing.

The second thing to be done is preparation of the text of the letter and the postscript (if needed). The text editor in my system normally places its storage buffer starting at location 100H. The first character is an FFH so the program looks at location 101H for the start of the letter text.

The text is stored in the buffer area with FFH as the delimiting end marker. This marker is also used in the program to signify the end of the regular text and also the end of the postscript when it is used. If a postscript is used in the letter, I type it first in the buffer area, then locate the end of file and transfer the text to location 0000. The program looks for the first postscript character at location 0001 (because of the leading FF). The final memory map of a full letter is thus with the postscript at location 01 and the letter text at location 101H. Both the postscript and the letter are terminated with an FFH.

The date for the letter is imbedded in the program starting at relative location 11F'H. This is best changed by loading the program at its run location and changing the binary code. It was placed in the program because it is normally changed once for any one set of mailings, and this makes the programming and program running easier.

After preparation of the postscript and text, I load the program just above the text (generally at location 700H) and do a binary save of the whole mess for ease in coming back to do several runs of letters. Note that the program is in relocatable format. The addresses which change with program location are marked with "'" in the listing. Fortunately there are very few addresses which change because of the extensive use of relative jumps.

DESCRIPTION OF THE PROGRAM

A complete assembly listing of the program is appended at the end of the article. The listing can best be explained by the use of flow diagrams. The first of these (Figure 7) shows the sequence of operations for determining the correct command from the input and calling the relevant subroutine. The only thing to note here is that the input is converted to lower case so that either lower case or upper case commands are accepted. Escape from the program is done by typing 'control-C'.

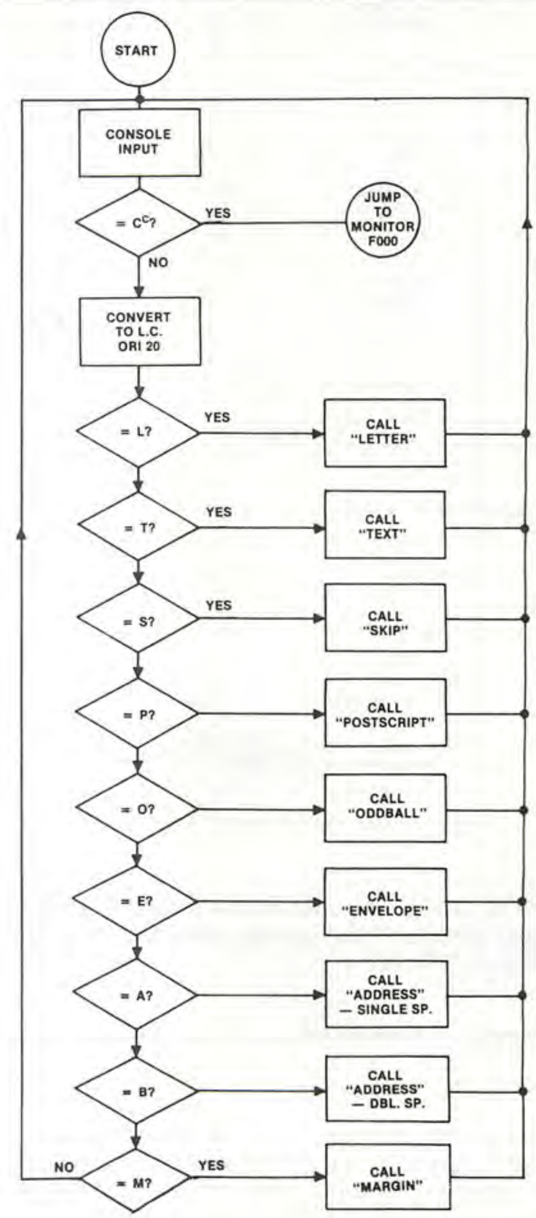


Figure 7. INPUT. The entry and control routine. All subroutines return here and normal escape from the program is from here.

the B register is decremented to zero. The program next gives three CRLF's, sets up the address of the buffer in the HL register, and proceeds to read the tape. Non-ASCII characters are eliminated, thus removing the start and blank characters on the tape, and any other characters are stored in the buffer and typed by the printer until the CR. When the first CR is found, the program continues to read the tape but only prints the data and does not store it any further. Printing continues until the address termination sign (~) is detected.

After getting and typing the date and the address of the recipient, the program gives two CRLF's and prints "Dear". Next, subroutine TITNAM is called. This consists of a control routine which does all of the typing control and a further subroutine which detects and flags the common titles. The flow diagram for TITNAM is given in Figure 9. The 16 bit register HL is used to point to the absolute location in the buffer (where we just put the first line of the address), and this is initialized to the start of the buffer. A second pointer is used as a relative counter for backing up or going forward from the absolute pointer. The value of HL is stored to establish the value for recall. This fits with the way the program runs in the later stages.

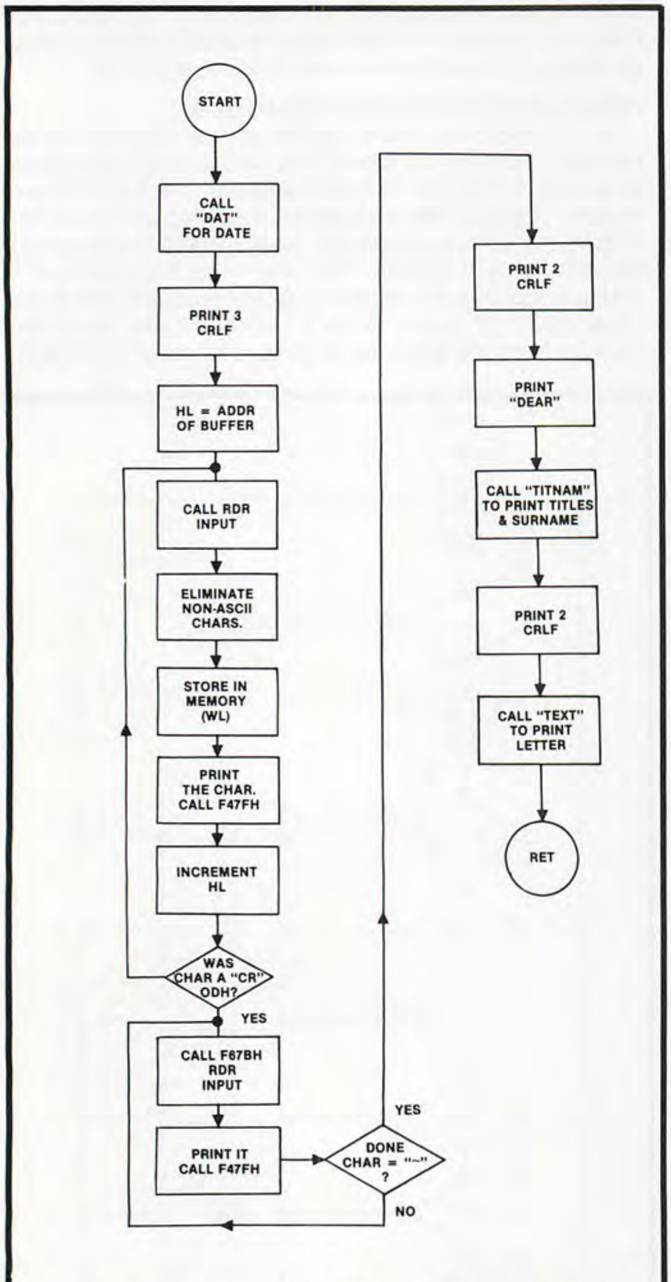


Figure 8. Letter. The routine for typing a letter in fully automatic mode. This routines calls one important subsoutine — TITNAM.

Most of the program is fairly straightforward. However, an interesting part which will be explained further is the code for typing a letter in full automatic mode. This routine is called LETTER, and it consists of a control routine with a number of subroutines. The control routine for LETTER is shown in Figure 8. On entry, the program first calls a subroutine for typing the date. This is a simple routine with the date presented at a specific memory location. The data is printed until the count in

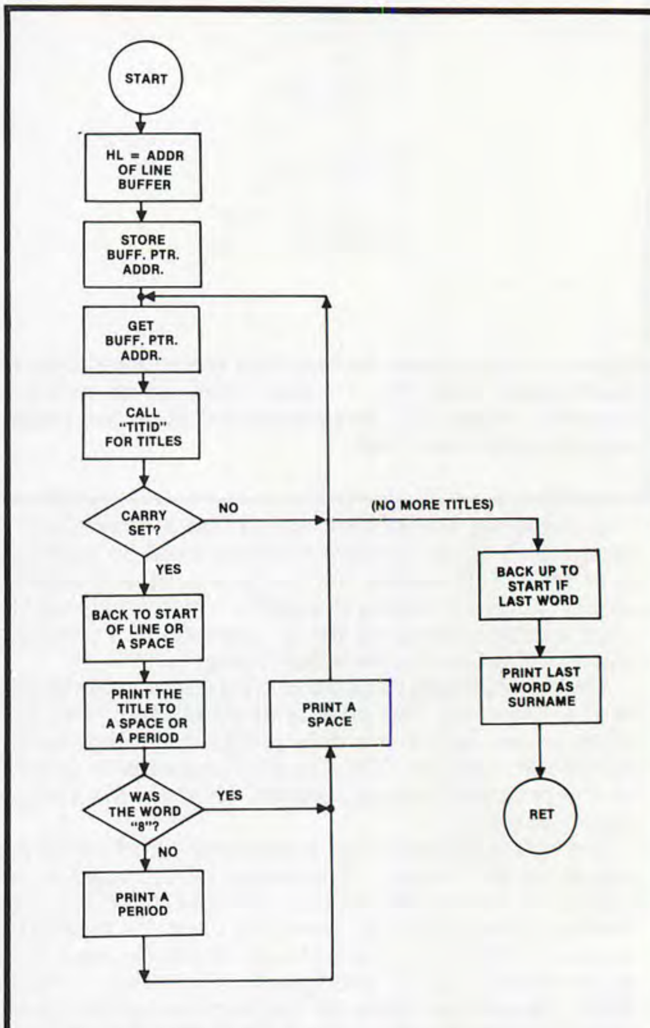


Figure 9. TITNAM. Controls the selection and typing of the title(s) and the surname of the addressee. This routine in turn calls TITID to search for a title match.

The routine immediately calls the subroutine TITID to look for matches with most of the common titles. The flow diagram for TITID is shown in Figure 9. This is a simple logical search for one of the titles from the list "Mr Mrs Miss Ms Dr &". When a complete match is found up to a period or a space, the carry is set and a return affected. Otherwise, the routine continues to look for a match until the end of the line. A carry set indicates to the control routine TITNAM that a title was found and that a backup to the first space or start of the line should be made and then the word should be printed. If there was no carry set on a return, the end of line has been reached without any further titles, and the program backs up to the previous space and types the last word for the surname. After typing the last word, control is returned to LETTER.

Once the complicated business of typing the title is finished, LETTER prints two CRLF's and then calls a very simple routine to print the text of the letter.

All of the other routines in the program are well commented in the listing and shouldn't need diagramming. Some of the conventions used by system and program need explanation, however. My paper tape convention uses eight FF's as start and end markers. In addition, paper tape punched from the text editor has a pre-end marker of a number of 1A's (HEX notation). The program is looking for and using these markers.

Table II. Monitor Subroutine Calls

There are four calls to I/O subroutines which reside in the system monitor. If the user has a monitor other than the TDL "Zapple" monitor then these calls will have to be modified appropriately. For convenience the call locations are listed below with a brief description of their function.

a.F000H This is the start of my monitor and is used in the program as a return either from the program or an an error trap.

0006

b.F478H This monitor routine prints the contents of the "C" register on the console (CRT). The byte is treated as an ASCII character.

0091 009A 009F 01FB 0236 023D

c.F47FH This monitor routine prints the contents of the "C" register on the list device which, in this case, is the Diablo printer.

005F 0064 006D 0074 0081 00B5 00E1 00F6 011A 014C 015D 0169 016E 0212 0228 0263 0297

d.F613H A monitor routine for obtaining a console input. In this case the character is an ASCII control or alphanumeric character. The character is returned in the "A" register.

0001 021C

e.F67BH This monitor routine obtains a character from the high speed reader. The routine contains a time out loop in case the tape is jammed or the reader has not been turned on.

0086 008D 00A2 00A9 00D0 00E9 00EE 0206 0254 025B 0268 0277 027A

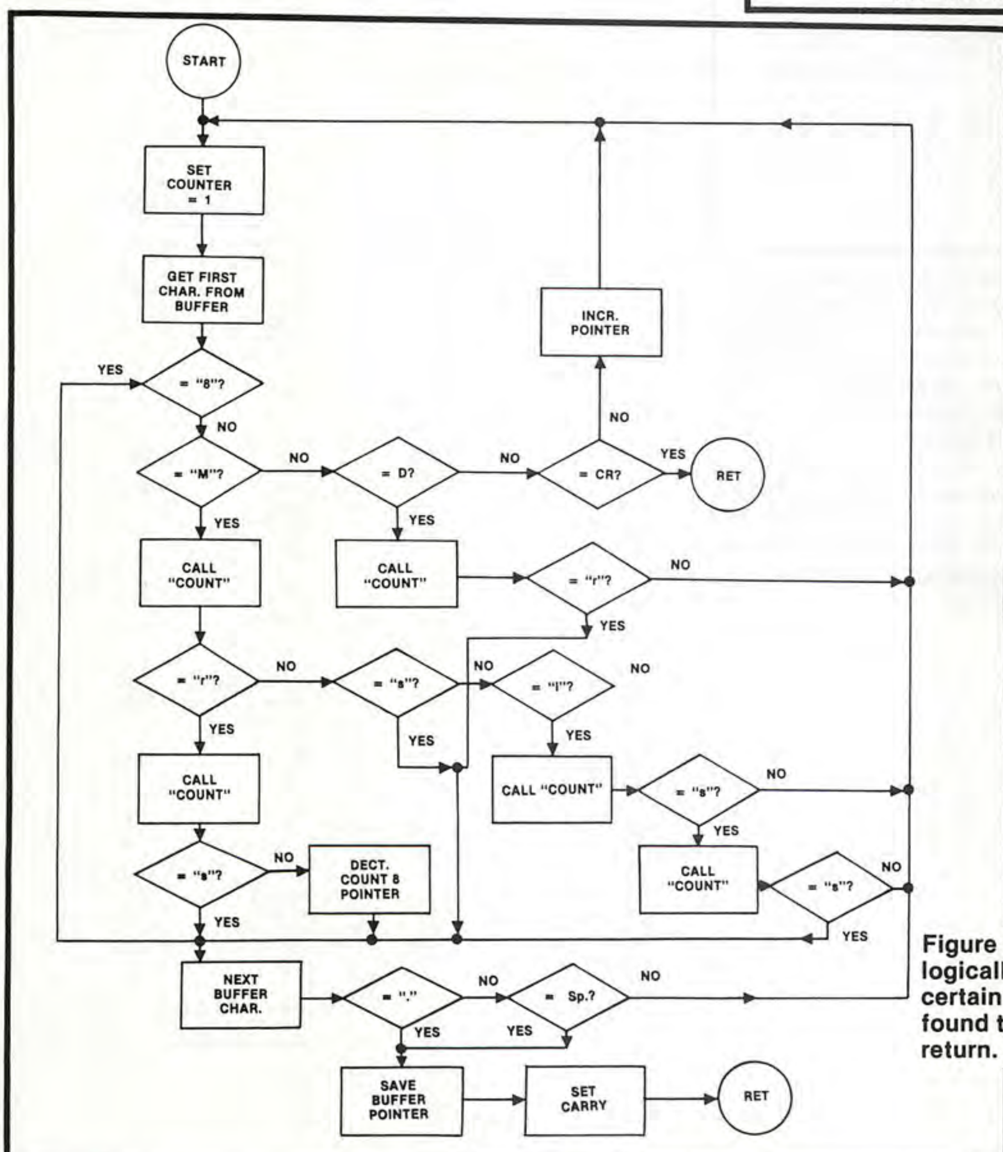


Figure 10. TITID. This subroutine logically searches for a match with certain common titles. If a match is found then the carry bit is set before return.

Table III. Listing of the program set up for the run location of 7000H.

```
>D700 99C

0700  CD 13 F6 FE 03 CA 00 F0 F6 20 FE 6C 20 05 CD C2
0710  07 18 ED FE 74 20 05 CD 77 07 18 E4 FE 73 20 05
0720  CD 85 07 18 DB FE 70 20 05 CD 43 09 18 D2 FE 6F
0730  20 05 CD CE 08 18 C9 FE 65 20 05 CD 05 09 18 C0
0740  FE 61 20 05 CD 4A 09 18 B7 FE 62 20 05 CD 4E 09
0750  18 AE FE 6D 20 AA CD 68 07 18 A5 C5 0E 0D CD 7F
0760  F4 0E 0A CD 7F F4 C1 C9 06 0F 0E 20 CD 7F F4 10
0770  F9 0E 14 CD 7F F4 C9 21 01 01 7E FE FF C8 4F 23
0780  CD 7F F4 18 F5 CD 7B F6 FE 0D 20 03 CD 7B F6 4F
0790  CD 78 F4 FE 0D 20 F5 0E 0D CD 78 F4 0E 0A CD 78
07A0  F4 CD 7B F6 FE 7E 20 F9 CD 7B F6 FE 0D 20 F9 C9
07B0  06 01 0E FF CD 7F F4 10 F9 21 1F 08 06 0D CD 17
07C0  08 C9 CD B0 07 06 03 CD 5B 07 10 FB 21 9D 09 CD
07D0  7B F6 FE 30 38 F9 FE 7F 28 F5 FE 7E 28 F1 77 4F
07E0  CD 7F F4 23 FE 0D 28 05 CD 7B F6 18 F1 CD 7B F6
07F0  FE 7E 28 06 4F CD 7F F4 18 F3 06 02 CD 5B 07 10
0800  FB 06 05 21 2C 08 CD 17 08 CD 31 08 06 02 CD 5B
0810  07 10 FB CD 77 07 C9 4E 23 CD 7F F4 10 F9 C9 46
0820  65 62 2E 20 32 30 20 20 31 39 37 38 44 65 61 72
0830  20 21 9D 09 22 CB 08 2A CB 08 CD 72 08 38 11 2B
0840  7E FE 20 20 FA 23 7E FE 0D C8 4F CD 7F F4 18 F5
0850  78 32 CD 08 28 10 FD 3A CD 08 47 4E CD 7F F4 23
0860  10 F9 FE 26 28 05 0E 2E CD 7F F4 0E 20 CD 7F F4
0870  18 C5 06 01 7E FE 26 28 3F FE 4D 28 0A FE 44 28
0880  30 FE 0D C8 23 18 EB CD C7 08 FE 72 28 18 FE 73
0890  28 26 FE 69 20 DC CD C7 08 FE 73 20 D5 CD C7 08
08A0  FE 73 20 CE 18 12 CD C7 08 FE 73 28 0B 05 2B 18
08B0  07 CD C7 08 FE 72 20 BA 23 7E FE 2E 28 04 FE 20
08C0  20 B0 22 CB 08 37 C9 04 23 7E C9 00 00 00 CD B0
08D0  07 06 03 CD 5B 07 10 FB CD 05 09 06 02 CD 5B 07
08E0  10 FB 06 05 21 00 09 CD F8 08 CD 16 09 06 02 CD
08F0  5B 07 10 FB CD 77 07 C9 4E 23 CD 78 F4 10 F9 C9
0900  4E 61 6D 65 3F CD 7B F6 FE 7E C8 FE 1A CA 00 07
0910  4F CD 7F F4 18 EF 06 00 21 9D 09 CD 13 F6 FE 0D
0920  20 0C 77 21 9D 09 4E CD 7F F4 23 10 F9 C9 FE 7F
0930  20 08 2B 05 4E CD 78 F4 18 E1 77 4F CD 78 F4 23
0940  04 18 D8 21 01 00 CD 7A 07 C9 3E 01 18 02 3E 02
0950  32 CD 08 CD 7B F6 FE 7F 20 F9 CD 7B F6 FE 7F 28
0960  F9 4F CD 7F F4 06 50 CD 7B F6 FE 1A 20 04 CD 5B
0970  07 C9 FE 7E 20 11 CD 7B F6 CD 7B F6 3A CD 08 47
0980  CD 5B 07 10 FB 18 DE FE 0D 20 04 3E 3B 18 06 FE
0990  0A 20 02 3E 20 4F CD 7F F4 10 CC 18 DF
>
```

To save the program space, the program makes extensive use of I/O subroutines contained in the Monitor. These with their program call addresses are listed in Table II. Finally, in Table III, I have provided a HEX listing of the program set up for starting location 700H. This is the location I use since it is most convenient for a binary dump of the entire program and letter text.

Using this program, some 300 letters were typed over a period of 3 days using a previously prepared address tape. The result was spectacular and presented an excellent image of the organization for which it was provided. I hope that you find the program useful also.☐

PROGRAM LISTING

```
                .TITLE 'A PROGRAM FOR WRITING LETTERS'
                .RADIX 16
                ;A Z-80 Relocatable Assembler program for writing
                ;a number of letters for which the addresses
                ;have been previously punched in paper tape
                ;L=Addr.+Letter**T=text only**S=Skip addr.
                ;P=Postscript**O=Oddball Addresses
                ;E=Envelope**M=Margin Set**A=List Addresses
                ;with single spaces**B=same--double spaced
                ;
0000' CD F613   INPUT:  CALL   0F613   ;CONSOLE INPUT ROUTINE
0003' FE03              CPI    03      ;DONE?
0005' CA F000           JZ     0F000   ;"  YES-BACK TO MONITOR
0008' F620              ORI    20      ;CONVERT ALL TO LOWER CASE
000A' FE6C              CPI    6C      ;IS IT A FULL LETTER?
000C' 2005              JRNZ   TTEXT   ;
000E' CD 00C2'          CALL   LETTER  ;TYPE THE LETTER
0011' 18ED              JMPR   INPUT   ;RETURN TO START
0013' FE74      TTEXT:  CPI    74      ; S IT TEXT ONLY?
0015' 2005              JRNZ   SKIPT   ;
0017' CD 0077'          CALL   TEXT    ; ONLY
001A' 18E4              JMPR   INPUT   ;
001C' FE73      SKIPT:  CPI    73      ;SKIP?
001E' 2005              JRNZ   POSTT   ;
0020' CD 0085'          CALL   SKIP    ;
0023' 18DB              JMPR   INPUT   ;
0025' FE70      POSTT:  CPI    70      ;POSTSCRIPT?
0027' 2005              JRNZ   ODDBT   ;
0029' CD 0243'          CALL   POST    ;
002C' 18D2              JMPR   INPUT   ;
002E' FE6F      ODDBT:  CPI    6F      ;ODDBALL?
0030' 2005              JRNZ   ENVT    ;
0032' CD 01CE'          CALL   ODDB    ;
0035' 18C9              JMPR   INPUT   ;
0037' FE65      ENVT:   CPI    65      ;ENVELOPE?
0039' 2005              JRNZ   ADDR1   ;
003B' CD 0205'          CALL   ENV     ;
003E' 18C0              JMPR   INPUT   ;
0040' FE61      ADDR1:  CPI    61      ;SINGLE SP. ADDR.?
0042' 2005              JRNZ   ADDR2   ;
0044' CD 024A'          CALL   ADD1    ;
0047' 18B7              JMPR   INPUT   ;
0049' FE62      ADDR2:  CPI    62      ;DOUBLE SP. ADDR.?
004B' 2005              JRNZ   MARGT   ;
004D' CD 024E'          CALL   ADD2    ;
0050' 18AE              JMPR   INPUT   ;
0052' FE6D      MARGT:  CPI    6D      ;SET MARGIN?
0054' 20AA              JRNZ   INPUT   ;
0056' CD 0068'          CALL   MARG    ;
0059' 18A5              JMPR   INPUT   ;
005B' C5        CRLF:   PUSH   B       ;START CRLF ROUTINE
005C' 0E0D              MVI    C,0D    ;SET CR
005E' CD F47F           CALL   0F47F   ;PRINT IT
0061' 0E0A              MVI    C,0A    ;SET LF
0063' CD F47F           CALL   0F47F   ;& PRINT THAT
0066' C1                POP    B       ;RETURN STATUS
0067' C9                RET            ;BACK TO START
0068' 060F      MARG:   MVI    B,0F    ;NUMBER OF SPACES
006A' 0E20      MAR1:   MVI    C,20    ;
006C' CD F47F           CALL   0F47F   ;
006F' 10F9              DJNZ   MAR1    ;
0071' 0E14              MVI    C,14    ;CHAR TO SET LEFT MARG
0073' CD F47F           CALL   0F47F   ;DO IT
0076' C9                RET            ;
0077' 21 0101   TEXT:   LXI    H,101   ;START ADDRESS OF TEXT
007A' 7E        TEXTC:  MOV    A,M     ;GET A BYTE
007B' FEFF              CPI    0FF     ;DONE?
007D' C8                RZ             ;YES--NOW BACK TO START
007E' 4F                MOV    C,A     ;READY FOR PRINTING
007F' 23                INX    H       ;INCREMENT THE ADDRESS
0080' CD F47F           CALL   0F47F   ;PRINT IT
0083' 18F5              JMPR   TEXTC   ;KEEP PRINTING THE TEXT
0085' CD F67B   SKIP:   CALL   0F67B   ;RDR INPUT
0088' FE0D              CPI    0D      ;FIRST CR?
008A' 2003              JRNZ   SKIP0   ;
008C' CD F67B   SKI:    CALL   0F67B   ;
008F' 4F        SKIP0:  MOV    C,A     ;
0090' CD F478           CALL   0F478   ;PRINT ON CRT
0093' FE0D              CPI    0D      ;CR?
0095' 20F5              JRNZ   SKI     ;NO
0097' 0E0D              MVI    C,0D    ;CR
0099' CD F478           CALL   0F478   ;
009C' 0E0A              MVI    C,0A    ;
009E' CD F478           CALL   0F478   ;
00A1' CD F67B   SKIP1:  CALL   0F67B   ;
00A4' FE7E              CPI    7E      ;DONE?
00A6' 20F9              JRNZ   SKIP1   ;
00A8' CD F67B   SKIP2:  CALL   0F67B   ;DUMMY TO BE RID OF CR
00AB' FE0D              CPI    0D      ;
00AD' 20F9              JRNZ   SKIP2   ;
00AF' C9                RET            ;
                ;Subroutine for writing a letter given a tape with
                ;names and addresses.  The routine picks the first
                ;line and puts it in a buffer then proceeds to
                ;write the letter with the proper title and the
                ;surname presented in the address.
                ;
00B0' 0601      DAT:    MVI    B,01    ;SET SPACES TO THE DATE
00B2' 0EFF      DAT1:   MVI    C,0FF   ;SPACES
00B4' CD F47F           CALL   0F47F   ;PRINT ONE
00B7' 10F9              DJNZ   DAT1    ;DO THEM ALL
00B9' 21 011F'          LXI    H,DATE  ;DATE TEXT
00BC' 060D              MVI    B,0D    ;LEN
00BE' CD 0117'          CALL   PRINT   ; TO PRINT IT
00C1' C9                RET            ;
00C2' CD 00B0'  LETTER: CALL   DAT     ;
00C5' 0603              MVI    B,3     ;3 TIMES
00C7' CD 005B'  STRT:   CALL   CRLF    ;DO A CRLF
00CA' 10FB              DJNZ   STRT    ;
00CC' 21 029D'          LXI    H,BUFR  ;FIRST LINE IS STORED
00CF' CD F67B   LETR1:  CALL   0F67B   ;READER INPUT
00D2' FE30              CPI    30      ;ELIMINATE
00D4' 38F9              JRC    LETR1   ;     NULLS/CRS/LFS
00D6' FE7F              CPI    7F      ;AND
00D8' 28F5              JRZ    LETR1   ;     RUBS
00DA' FE7E              CPI    7E      ;AND
00DC' 28F1              JRZ    LETR1   ;     ~'S
00DE' 77        LETRS:  MOV    M,A     ;STORE IT
00DF' 4F                MOV    C,A     ;
00E0' CD F47F           CALL   0F47F   ;& PRINT IT
00E3' 23                INX    H       ;
00E4' FE0D              CPI    0D      ;END OF FIRST ADDR LINE?
00E6' 2805              JRZ    LETR2   ;YES NOW JUST WRITE
00E8' CD F67B           CALL   0F67B   ;CONT FROM TAPE
00EB' 18F1              JMPR   LETRS   ;KEEP STORING
00ED' CD F67B   LETR2:  CALL   0F67B   ;RDR INP
00F0' FE7E              CPI    7E      ;DONE?
00F2' 2806              JRZ    LETR3   ;YES
00F4' 4F                MOV    C,A     ;
00F5' CD F47F           CALL   0F47F   ;PRINT IT
00F8' 18F3              JMPR   LETR2   ;
00FA' 0602      LETR3:  MVI    B,2     ;2 CRLF'S
00FC' CD 005B'  LETR4:  CALL   CRLF    ;
00FF' 10FB              DJNZ   LETR4   ;
0101' 0605              MVI    B,5     ;SET FOR 'DEAR
0103' 21 012C'          LXI    H,DEAR  ;LOCN
0106' CD 0117'          CALL   PRINT   ; TO PRINT
0109' CD 0131'          CALL   TITNAM  ;SET UP TITLE & NAME
010C' 0602              MVI    B,2     ;2 CRLF'S
010E' CD 005B'  LETR5:  CALL   CRLF    ;
0111' 10FB              DJNZ   LETR5   ;
0113' CD 0077'          CALL   TEXT    ;NOW FOR THE LETTER
0116' C9                RET            ;BACK TO START
0117' 4E        PRINT:  MOV    C,M     ;READY TO PRINT
0118' 23                INX    H       ;
0119' CD F47F           CALL   0F47F   ;PRINT IT
011C' 10F9              DJNZ   PRINT   ;
011E' C9                RET            ;
011F'           DATE:                  ;TEXT OF THE DATE
                .LIMAGE
011F' 4665622E20 .ASCII 'Feb. 2\
```

```
0124' 3230202031 \0  19\
0129' 393738     \78'
012C'            DEAR:                   ;TEXT OF DEAR
012C' 4465617220 .ASCII 'Dear '
                 .XIMAGE
                 ;
                 ;Subroutine for finding the titles and surname
                 ;in a buffered first line of names and address
                 ;where the first line of the name & address
                 ;contains the title(s) followed by anything
                 ;and a surname which terminates in a (CR).
                 ;
0131' 21 029D'   TITNAM: LXI   H,BUFR   ; ADDRESS OF LINE BUFFER
0134' 22 01CB'           SHLD  BUFST    ;STORE TEMP ADDR
0137' 2A 01CB'   TN1:    LHLD  BUFST    ;GET TEMP BUFFER ADDR
013A' CD 0172'           CALL  TITID    ;LOOK FOR TITLES
013D' 3811               JRC   TN2      ;TO PRINT A TITLE
                 ;Routine to print the surname
013F' 2B         TNX:    DCX   H        ;BACKUP
0140' 7E                 MOV   A,M      ;GET A CHAR
0141' FE20               CPI   20       ;SPACE?
0143' 20FA               JRNZ  TNX      ;LOOK AGAIN
0145' 23         TNX1:   INX   H        ;FORWARD
0146' 7E                 MOV   A,M      ;
0147' FE0D               CPI   0D       ;END?
0149' C8                 RZ             ;YES  ALL DONE
014A' 4F                 MOV   C,A      ;
014B' CD F47F            CALL  0F47F    ;PRINT
014E' 18F5               JMPR  TNX1     ;
                 ;Routine to print a title
0150' 78         TN2:    MOV   A,B      ;
0151' 32 01CD'           STA   CNTST    ;STORE COUNT
0154' 2B         TN3:    DCX   H        ;BAKCUP
0155' 10FD               DJNZ  TN3      ;     TO START OF TITLE
0157' 3A 01CD'           LDA   CNTST    ;GET COUNT
015A' 47                 MOV   B,A      ;
015B' 4E         TN4:    MOV   C,M      ;
015C' CD F47F            CALL  0F47F    ;PRINT
015F' 23                 INX   H        ;
0160' 10F9               DJNZ  TN4      ;
0162' FE26               CPI   26       ;WAS IT AN "&"?
0164' 2805               JRZ   TN5      ;YES SKIP THE "."
0166' 0E2E               MVI   C,2E     ;NO PRINT A "."
0168' CD F47F            CALL  0F47F    ;PRINT IT
016B' 0E20       TN5:    MVI   C,20     ;SPACE
016D' CD F47F            CALL  0F47F    ;
0170' 18C5               JMPR  TN1      ;BACK AGAIN
                 ;Routine to look for titles from one
                 ;of the following--Mr Mrs Ms Miss Dr and
                 ;to include any "&'s" as part of the
                 ;title as in "Mr. & Mrs."
                 ;
0172' 0601       TITID:  MVI   B,1      ;SET COUNT=1
0174' 7E                 MOV   A,M      ;GET FIRST CHAR
0175' FE26               CPI   26       ;& ?
0177' 283F               JRZ   TDE      ;YES
0179' FE4D               CPI   4D       ;M ?
017B' 280A               JRZ   TD1      ;NEXT?
017D' FE44               CPI   44       ;D ?
017F' 2830               JRZ   TD3      ;
0181' FE0D               CPI   0D       ;CR? (BUFFER LINE END)
0183' C8                 RZ             ;
0184' 23                 INX   H        ;NEXT BUFFER CHAR
0185' 18EB               JMPR  TITID    ;BACK TO TRY  A NEW CHAR
0187' CD 01C7'   TD1:    CALL  COUNT    ;TITLE COUNTING
018A' FE72               CPI   72       ;r ?
018C' 2818               JRZ   TD2      ;
018E' FE73               CPI   73       ;s ?
0190' 2826               JRZ   TDE      ;
0192' FE69               CPI   69       ;i ?
0194' 20DC               JRNZ  TITID    ;
0196' CD 01C7'           CALL  COUNT    ;THIRD CHAR
0199' FE73               CPI   73       ;s ?
019B' 20D5               JRNZ  TITID    ;
019D' CD 01C7'           CALL  COUNT    ;FOURTH CHAR
01A0' FE73               CPI   73       ;s ?
01A2' 20CE               JRNZ  TITID    ;
01A4' 1812               JMPR  TDE      ;
01A6' CD 01C7'   TD2:    CALL  COUNT    ;THIRD CHAR
01A9' FE73               CPI   73       ;s ?
01AB' 280B               JRZ   TDE      ;
01AD' 05                 DCR   B        ;FOR Mr ALONE
01AE' 2B                 DCX   H        ;
01AF' 1807               JMPR  TDE      ;
01B1' CD 01C7'   TD3:    CALL  COUNT    ;
01B4' FE72               CPI   72       ;r ?
01B6' 20BA               JRNZ  TITID    ;
01B8' 23         TDE:    INX   H        ;LOOK AT NEXT CHAR
01B9' 7E                 MOV   A,M      ;
01BA' FE2E               CPI   2E       ;PERIOD?
01BC' 2804               JRZ   TE1      ;
01BE' FE20               CPI   20       ;SPACE?
01C0' 20B0               JRNZ  TITID    ;
01C2' 22 01CB'   TE1:    SHLD  BUF.T    ;STORE POINTER
01C5' 37                 STC            ;SET CARRY FOR TITLE GOT
01C6' C9                 RET            ;WOW! BACK TO PROGRAM
01C7' 04         COUNT:  INR   B        ;COUNT UP
01C8' 23                 INX   H        ;MOVE POINTER
01C9' 7E                 MOV   A,M      ;GET A BYTE
01CA' C9                 RET            ;
01CB'            BUFST:                 ;BUFFER POINTER STORE
01CB'            .BLKB 2
01CD'            CNTST:                 ;COUNTER STORE
01CD'            .BLKB 1
                 ;A subroutine for writing letters where an unusual
                 ;name or title are used.
                 ;
01CE' CD 00B0'   ODDB:   CALL  DAT      ;TYPE THE DATE
01D1' 0603               MVI   B,3      ;
01D3' CD 005B'   ODDB2:  CALL  CRLF     ;
01D6' 10FB               DJNZ  ODDB2    ;
01D8' CD 0205'   ODD:    CALL  ENV      ;TYPE THE NAME AND ADDRESS
01DB' 0602               MVI   B,2      ;TWO CRLF'S
01DD' CD 005B'   ODD1:   CALL  CRLF     ;
01E0' 10FB               DJNZ  ODD1     ;
01E2' 0605               MVI   B,5      ;TO TYPE 'NAME?' ON CRT
01E4' 21 0200'           LXI   H,NAME   ;MESS. ADDR.
01E7' CD 01F8'           CALL  PRINC    ;
01EA' CD 0216'           CALL  TYPE     ;TO KEYBOARD ENTRY OF NAME
01ED' 0602               MVI   B,2      ;MORE CRLF'S
01EF' CD 005B'   ODD2:   CALL  CRLF     ;
01F2' 10FB               DJNZ  ODD2     ;
01F4' CD 0077'           CALL  TEXT     ;
01F7' C9                 RET            ;
01F8' 4E         PRINC:  MOV   C,M      ;
01F9' 23                 INX   H        ;
01FA' CD F478            CALL  0F478    ;CONSOLE O/P
01FD' 10F9               DJNZ  PRINC    ;
01FF' C9                 RET            ;
0200'            NAME:                  ;TEXT OF THE MESSAGE
0200' 4E616D653F .ASCII 'Name?'
0205' CD F67B    ENV:    CALL  0F67B    ;RDR INPUT
0208' FE7E               CPI   7E       ;DONE?
020A' C8                 RZ             ;YES
020B' FE1A               CPI   1A       ;END OF TAPE?
020D' CA 0000'           JZ    INPUT    ;YES BACK TO START
0210' 4F                 MOV   C,A      ;PRINT IT
0211' CD F47F            CALL  0F47F    ;
0214' 18EF               JMPR  ENV      ;GET MORE
                 ;Typewriter subroutine for oddball names
                 ;
0216' 0600       TYPE:   MVI   B,0      ;ZERO THE COUNT
0218' 21 029D'           LXI   H,BUFR   ;BUFFER START
021B' CD F613    TYPE1:  CALL  0F613    ;CONSOLE INPUT
021E' FE0D               CPI   0D       ;END OF LINE?
0220' 200C               JRNZ  TYPE3    ;NO  DO MORE
0222' 77                 MOV   M,A      ;
0223' 21 029D'           LXI   H,BUFR   ;
0226' 4E         TYPE2:  MOV   C,M      ;
0227' CD F47F            CALL  0F47F    ;PRINT IT
022A' 23                 INX   H        ;
022B' 10F9               DJNZ  TYPE2    ;KEEP TYPING
022D' C9                 RET            ;
022E' FE7F       TYPE3:  CPI   7F       ;RUB OUT?
0230' 2008               JRNZ  TYPE4    ;NO KEEP TYPING
0232' 2B                 DCX   H        ;
0233' 05                 DCR   B        ;
0234' 4E                 MOV   C,M      ;PRINT PREV CHAR
0235' CD F478            CALL  0F478    ;  ON CONSOLE
0238' 18E1               JMPR  TYPE1    ;
023A' 77         TYPE4:  MOV   M,A      ;STORE A CHAR
023B' 4F                 MOV   C,A      ;
023C' CD F478            CALL  0F478    ;& ECHO IT ON CONSOLE
023F' 23                 INX   H        ;
0240' 04                 INR   B        ;
0241' 18D8               JMPR  TYPE1    ;
                 ;Subroutine for printing postscripts
                 ;
0243' 21 0001    POST:   LXI   H,01     ;START ADDRESS OF POST
0246' CD 007A'           CALL  TEXTC    ;
0249' C9                 RET            ;

                 ;
                 ;Routine to type the address list
                 ;
024A' 3E01       ADD1:   MVI   A,01     ;
024C' 1802               JMPR  STOC     ;
024E' 3E02       ADD2:   MVI   A,02     ;
0250' 32 01CD'   STOC:   STA   CNTST    ;
0253' CD F67B    ADD:    CALL  0F67B    ;RDR INPUT
0256' FE7F               CPI   7F       ;START ?
0258' 20F9               JRNZ  ADD      ;NO
025A' CD F67B    ADD0:   CALL  0F67B    ;RDR INPUT
025D' FE7F               CPI   7F       ;STILL START?
025F' 28F9               JRZ   ADD0     ;YES
0261' 4F                 MOV   C,A      ;
0262' CD F47F            CALL  0F47F    ;PRINT FIRST CHAR.
0265' 0650       ADDL:   MVI   B,50     ;80 CHARS PER LINE
0267' CD F67B    ADDL1:  CALL  0F67B    ;GET A RDR CHAR
026A' FE1A               CPI   1A       ;END OF TAPE?
026C' 2004               JRNZ  ADDL2    ;
026E' CD 005B'           CALL  CRLF     ;
0271' C9                 RET            ;
0272' FE7E       ADDL2:  CPI   7E       ;END OF ADDR?
0274' 2011               JRNZ  ADDL4    ;
0276' CD F67B            CALL  0F67B    ;DUMMY RDR CHAR (CR)
0279' CD F67B            CALL  0F67B    ;SAME (LF)
027C' 3A 01CD'   ADDLC:  LDA   CNTST    ;
027F' 47                 MOV   B,A      ;
0280' CD 005B'   ADDL3:  CALL  CRLF     ;
0283' 10FB               DJNZ  ADDL3    ;
0285' 18DE               JMPR  ADDL     ;BACK FOR NEW ADDR
0287' FE0D       ADDL4:  CPI   0D       ;CR
0289' 2004               JRNZ  ADDL5    ;
028B' 3E3B               MVI   A,3B     ;YES, SUBST A SEMICOLON
028D' 1806               JMPR  ADDL6    ;
028F' FE0A       ADDL5:  CPI   0A       ;LF?
0291' 2002               JRNZ  ADDL6    ;
0293' 3E20               MVI   A,20     ;YES, SUBST A SPACE
0295' 4F         ADDL6:  MOV   C,A      ;READY TO TYPE
0296' CD F47F            CALL  0F47F    ;PRINT IT
0299' 10CC               DJNZ  ADDL1    ;SAME LINE?
029B' 18DF               JMPR  ADDLC    ;NO  DO CRLF ETC.
029D'            BUFR:                  ;BUFFER STORAGE START
                 .END
```

SYMBOL TABLE

```
ADD     0253'    ADD0    025A'    ADD1    024A'    ADD2    024E'
ADDL    0265'    ADDL1   0267'    ADDL2   0272'    ADDL3   0280'
ADDL4   0287'    ADDL5   028F'    ADDL6   0295'    ADDLC   027C'
ADDR1   0040'    ADDR2   0049'    BUFR    029D'    BUFST   01CB'
CNTST   01CD'    COUNT   01C7'    CRLF    005B'    DAT     00B0'
DAT1    00B2'    DATE    011F'    DEAR    012C'    ENV     0205'
ENVT    0037'    INPUT   0000'    LETR1   00CF'    LETR2   00ED'
LETR3   00FA'    LETR4   00FC'    LETR5   010E'    LETRS   00DE'
LETTER  00C2'    MAR1    006A'    MARG    0068'    MARGT   0052'
NAME    0200'    ODD     01D8'    ODD1    01DD'    ODD2    01EF'
ODDB    01CE'    ODDB2   01D3'    ODDBT   002E'    POST    0243'
POSTT   0025'    PRINC   01F8'    PRINT   0117'    SKI     008C'
SKIP    0085'    SKIP0   008F'    SKIP1   00A1'    SKIP2   00A8'
SKIPT   001C'    STOC    0250'    STRT    00C7'    TD1     0187'
TD2     01A6'    TD3     01B1'    TDE     01B8'    TE1     01C2'
TEXT    0077'    TEXTC   007A'    TITID   0172'    TITNAM  0131'
TN1     0137'    TN2     0150'    TN3     0154'    TN4     015B'
TN5     016B'    TNX     013F'    TNX1    0145'    TTEXT   0013'
TYPE    0216'    TYPE1   021B'    TYPE2   0226'    TYPE3   022E'
TYPE4   023A'
```

Heathkit Model H10 Paper Tape Reader/Punch

A Review

By Roger H. Edelson, Hardware Editor

This is not one of my normal card-of-the-month articles as I didn't build the Reader/Punch described herein. However, I have spent a reasonable amount of time with the Heathkit Reader/Punch.

The Heathkit H10 provides a reasonable cost method of reading and punching standard 8-level, 1-inch paper tape. The Reader/Punch can accommodate either fanfold or up to a 10-inch diameter roll of oiled or unoiled paper tape. The maximum reading speed is 50 characters per second, and up to 10 characters a second is the maximum punch speed.

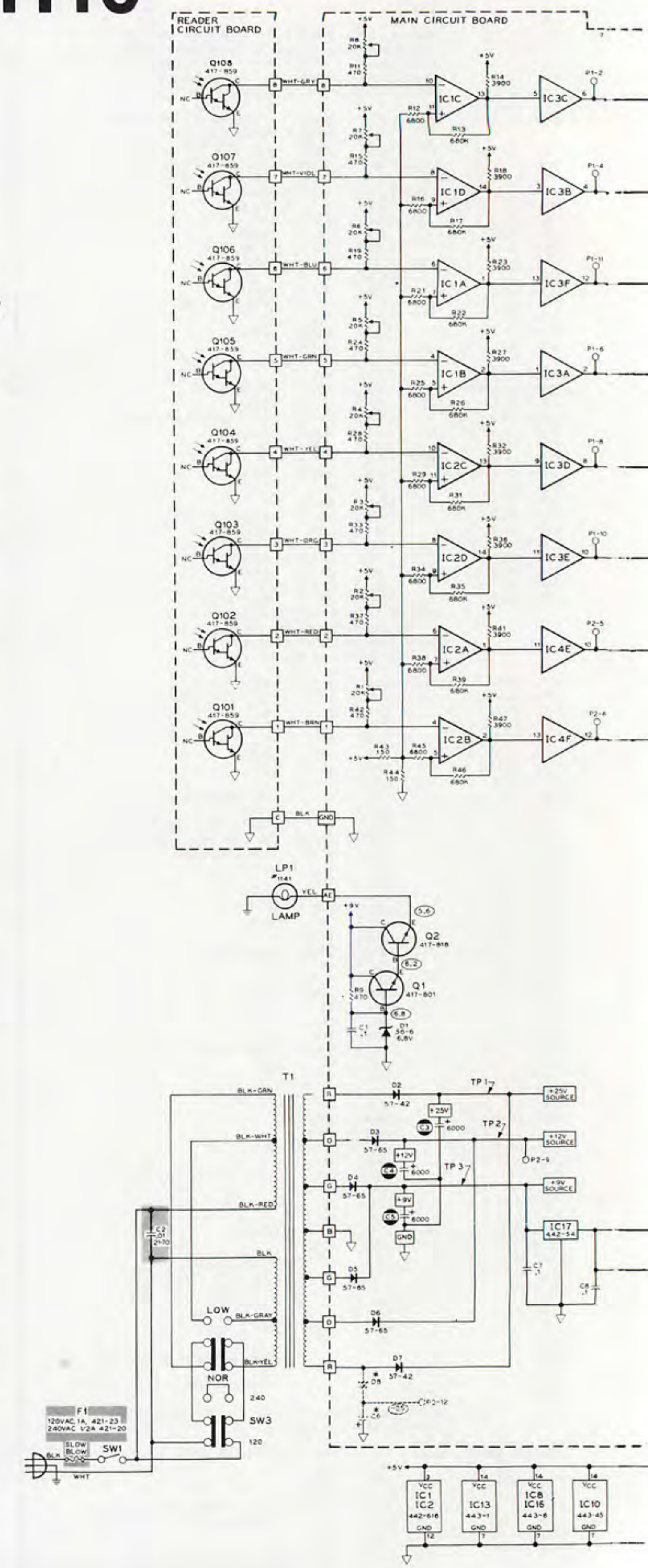
Both the reader and punch may be operated simultaneously and yet controlled independently. The H10 has a standard TTL parallel interface and uses a photo-electric tape reader rather than electro-mechanical types to achieve reliable operation. Independent adjustment of the "1/0" threshold is provided for each channel. The tape reader transport is driven by a stepper motor in order to achieve dependable operation. An additional nice touch is a pushbutton feed switch to generate as much leader tape as desired and a pushbutton switch to permit the easy copying of other tapes.

. . .the instructions are typical Heath; an entire eighty page manual is provided to guide you through the construction. . .the manual provides clear and detailed text . . .

As I didn't build this device I can't comment directly on its construction. However, the instructions are typical Heath; an entire eighty page manual is provided to guide you through the construction. As in all Heathkits, the assembly manual provides clear and detailed text liberally sprinkled with the necessary pictures. Each step is checked off as it is completed, and scales are provided for the measurement of the hookup wires which are to be cut to the length specified in the manual. All this is standard Heath but must come as a sort of a shock to persons familiar with the rather barren fare of the standard computer kit manuals.

The Reader/Punch is divided into a number of different functional areas which makes it convenient to discuss each section separately. Figure 1 provides a full view of the schematic and will be used in the following discussions.

Reading of the paper tape is performed by a photo-Darlington transistor Q101. This device provides a high gain conversion from the light passing through the tape



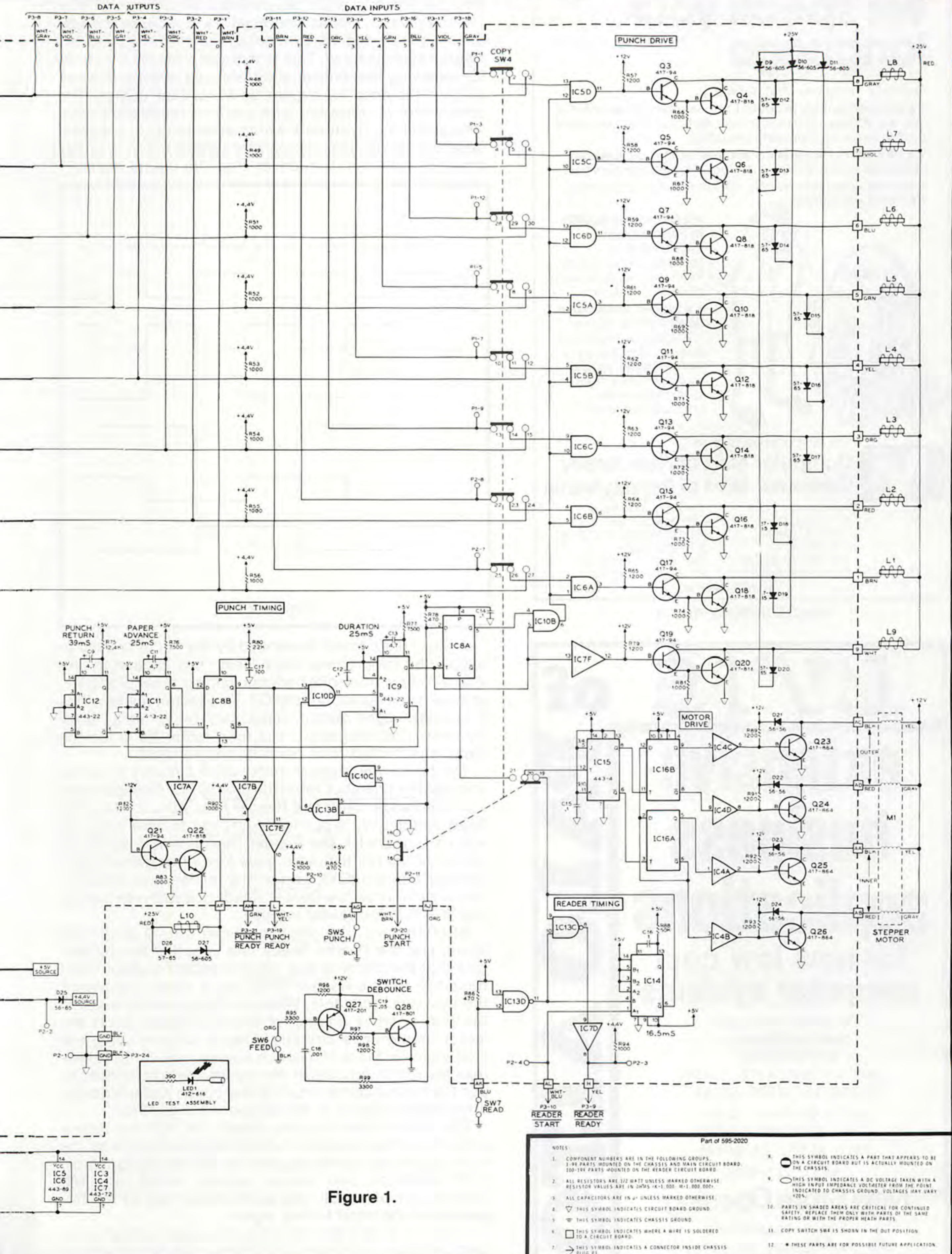

DATA OUTPUTS
DATA INPUTS
COPY SW4
PUNCH DRIVE
PUNCH TIMING
PUNCH RETURN 39mS
PAPER ADVANCE 25mS
DURATION 25mS
MOTOR DRIVE
READER TIMING
STEPPER MOTOR
SWITCH DEBOUNCE
SW5 PUNCH
SW6 FEED
SW7 READ
PUNCH READY
PUNCH READY
PUNCH START
READER START
READER READY
LED TEST ASSEMBLY
16.5mS
Part of 595-2020
NOTES:
1. COMPONENT NUMBERS ARE IN THE FOLLOWING GROUPS. 1-99 PARTS MOUNTED ON THE CHASSIS AND MAIN CIRCUIT BOARD. 100-199 PARTS MOUNTED ON THE READER CIRCUIT BOARD.
2. ALL RESISTORS ARE 1/2 WATT UNLESS MARKED OTHERWISE. RESISTOR VALUES ARE IN OHMS (K=1,000; M=1,000,000).
3. ALL CAPACITORS ARE IN µF UNLESS MARKED OTHERWISE.
4. THIS SYMBOL INDICATES CIRCUIT BOARD GROUND.
5. THIS SYMBOL INDICATES CHASSIS GROUND.
6. THIS SYMBOL INDICATES WHERE A WIRE IS SOLDERED TO A CIRCUIT BOARD.
7. THIS SYMBOL INDICATES A CONNECTOR INSIDE CHASSIS PLUG P3.
8. THIS SYMBOL INDICATES A PART THAT APPEARS TO BE ON A CIRCUIT BOARD BUT IS ACTUALLY MOUNTED ON THE CHASSIS.
9. THIS SYMBOL INDICATES A DC VOLTAGE TAKEN WITH A HIGH INPUT IMPEDANCE VOLTMETER FROM THE POINT INDICATED TO CHASSIS GROUND. VOLTAGES MAY VARY ±20%.
10. PARTS IN SHADED AREAS ARE CRITICAL FOR CONTINUED SAFETY. REPLACE THEM ONLY WITH PARTS OF THE SAME RATING OR WITH THE PROPER HEATH PARTS.
11. COPY SWITCH SW4 IS SHOWN IN THE OUT POSITION.
12. * THESE PARTS ARE FOR POSSIBLE FUTURE APPLICATION.

Figure 1.

holes to an electrical current. This current flowing through resistors produces a voltage which is sensed by the comparator. One of the resistors is variable, thereby allowing individual adjustment of the I/O discrimination level of each channel. This technique provides a method for removing the individual differences of each channel without the need for expensive worst-case design. The comparator is designed with positive feedback to provide switching hysteresis which eliminates (or reduces) false triggering. The comparator output drives a buffer amplifier, which in turn drives the data output lines.

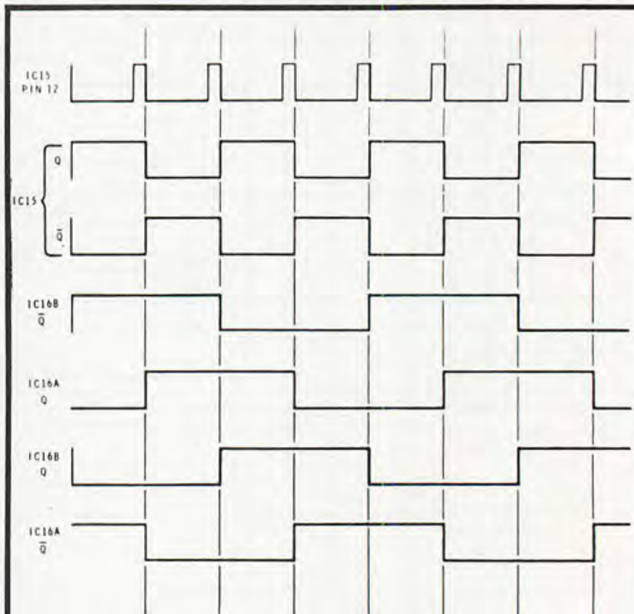


Figure 2.

A nice Heath touch is evinced by the circuitry used to supply the lamp power. Here Heath has chosen to provide a voltage controlled source using a zener diode, D1, and two transistors, Q1 and Q2. This technique provides a constant light output, necessary for reliable "hole/no hole" discrimination, and long lamp life since the lamp is protected from harmful over-voltages.

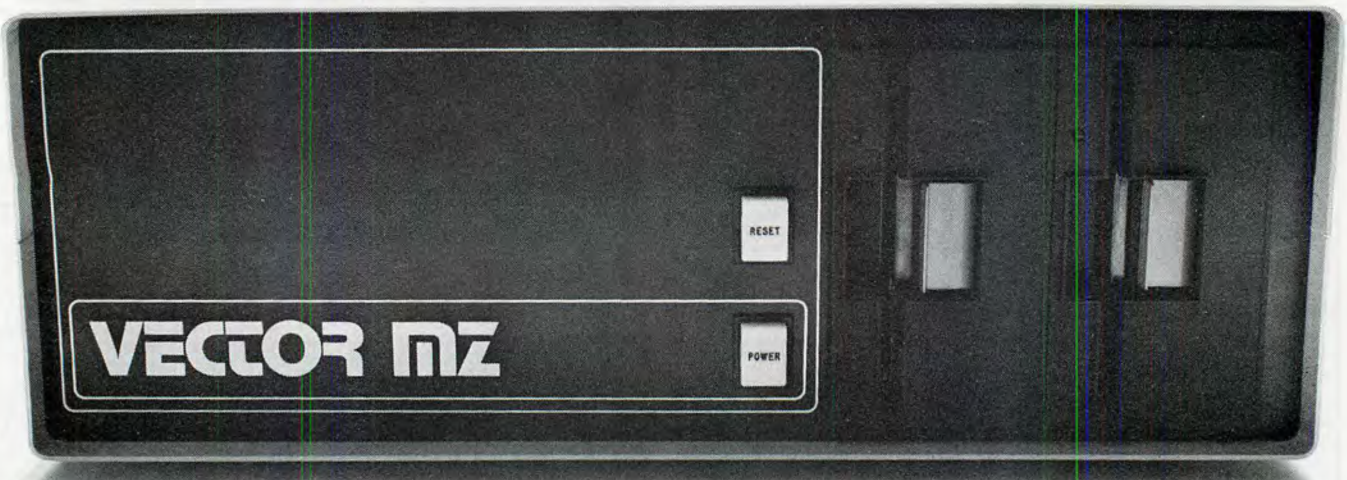
Timing for the stepper motor drive circuitry is generated by the one-shot multivibrator IC14, in conjunction with the Reader Start and Reader Ready lines. When the Read switch SW7 is pushed to ON, the 16.5 ms one-shot will be triggered if the Reader Start line is low. The $\overline{Q}$ output of the multivibrator goes low, driving the trigger input of flip-flop IC15, part of the motor drive circuitry. At the same time, the Reader Ready line is driven high to indicate that the reader is busy.

After 16.5 ms, the one-shot times out, $\overline{Q}$ goes high again, and the Reader Ready line is pulled low to indicate that the reader is now ready to accept another 1-to-0 transition on the Reader Start line in order to advance the tape one more hole. When the Copy switch is set to the copy position, the punch timing circuitry drives the motor timing drive circuitry directly without using the multivibrator. Since the punch always runs much slower than the maximum rate of the reader, there is no need to use the handshaking circuitry; the punch just provides a drive signal directly to the trigger input of IC15.

The motor drive circuitry takes the 16.5 ms timing pulse from the one-shot multivibrator and produces the 4-phase driving pulses required by the stepping motor. IC15 produces two output signals which are 180 degrees out of phase, and each is one half of the frequency of the input timing signal.

To better understand this circuitry, refer to the timing diagram given in Figure 2. To follow the circuit action, assume that when power is applied, the $\overline{Q}$ outputs of

Brand New! VECTOR MZ at Super Discount Prices!



A standard MZ microcomputer, discount priced at $2695, includes these fine features: Z80 microprocessor. single floppy disk drive with 315K bytes of storage, 32K memory, one serial port, two parallel ports, disk controller, 12K PROM/RAM with monitor, Extended Disk BASIC and room for 18 S-100 boards. To expand your disk storage to 630K bytes, add another disk drive for $680.

FREE

Introductory Offer

While supply lasts.

SAVE up to $375 on your MZ System and receive FREE a BASIC programming manual and a box of diskettes.

To complete your system...

Add a SOROC Terminal and add $939. SAVE $56.00.

Add a Centronics 779 and add $1075. SAVE $100.00.

Add a Hazeltine 1500 and add $1146. SAVE $79.00.

Your total savings on a complete MZ Microsystem can add up to as much as $554.00!

All prices include full system integration, completely assembled with 90-day written warranty.

Sunshine Computer Company

20710 South Leapwood Ave. • Carson, California 90746 • (213) 327-2118

CIRCLE INQUIRY NO. 97

IC15 and IC16A are high and IC16B-Q is also high. Because the D inputs of the IC16 A&B flip-flops are tied to the $\overline{Q}$ output of IC16A, the Q output of IC16A will be driven high. This is where the timing sequence shown in *the figure* begins.

With the first pulse to the trigger input of IC15, the flip-flop inverts its state, and the Q output goes low and $\overline{Q}$ goes high. Because the $\overline{D}$ inputs of IC16 are high, IC16B output goes high and $\overline{Q}$ goes low. The other half of IC16, IC16A, is unaffected. The next time IC15 changes state, IC16B remains unchanged and IC16A inverts its outputs. As the input pulses to IC15 continue, the result of this action is to produce a 4-phase signal that is applied through buffers to the motor drive transistors Q23 through Q26. The diodes D21 through D24 are used to suppress the inductive voltage spikes generated by the motor windings when the drive current is terminated.

The punch solenoids are driven by Darlington transistor pairs in order to provide the high current required by the solenoid while interfacing with standard logic. Again, diodes are used to prevent inductive overvoltages from damaging the drive transistors. However, in this case, in order to shorten the punch recovery time, the diodes are clamped instead to a voltage about 20 volts above the supply. The clamp voltage is set by a zener diode. The drive for the punch is the logical AND of a punch drive timing signal (derived from IC10B - Pin 6) and the data signal from either the data input connector or the tape read circuit (if the copy switch is set for copy).

The punch solenoids are driven by Darlington transistor pairs in order to provide the high current required. . .

Three one-shot multivibrators control the punch timing. IC9 controls the duration of the punching operation, IC12 provides the time for the punches to return to their normal positions, and IC11 times the paper-advance solenoid. The multivibrators are interconnected so they will perform their timing functions in the proper sequence.

Gate IC10B is for circuit protection. Without it, when the unit is turned on, the Q output of IC8A could be high and possibly turn on all the solenoids continuously. This could blow the fuse or damage the solenoids.

When the Feed switch is pushed, the pulse is debounced by Q27 and Q28, and the output of gate IC10C goes low and starts the timing of IC9; its Q output goes high. This operates solenoid L9 (through IC7F, and Q19 and Q20) and transfers the low at the D input of IC8A to the Q output. With a low and a high at the inputs of IC10B, solenoids L1 through L8 remain off.

When the Q output of IC9 goes high, the $\overline{Q}$ output goes low. After IC9 times out, the $\overline{Q}$ output goes high again and starts IC12 and drives its $\overline{Q}$ low. This does not affect IC11 at this time, but it does clear IC8A and turns off the punch drivers.

When IC12 times out, its $\overline{Q}$ output goes high and starts IC11, driving its Q output high. This drives IC7A and transistors Q21 and Q22 to drive tape advance solenoid L10. When IC11 times out, its $\overline{Q}$ output goes high and forces a high at the Q output of IC8B, which had been cleared when IC9 started timing out. This is transferred to the Punch Ready output by IC7E. This high at pin 13 of IC10D now allows the Punch and Feed switches or a "punch start" signal at P3-19 to control the punching.

In normal operation, a transition from high to low on the "punch start" line (P3-19) will be coupled through IC10C to trigger IC9.

The power supply is relatively standard with a single three-terminal regulator providing the 5 volt logic power. Heath has provided their normal nice touches by having a 120/240 selector switch — something not found on most home computer equipment. Additionally, in order to optimize the punch drive circuits, a switch is provided to adjust the reader/punch power supply for either low or normal line voltage conditions.

The mechanical design is typically Heathkit, generally effective and buildable by the home hobbyist. The major problem would appear to be the necessary compromise between kitability and cost and precision. The punch suffers the most from this problem with the major symptom being a long, almost tortuous, path from the back of the unit to the punch itself. While the long channel serves to provide registration for the paper tape, the whole process of loading a tape for punching is invisible to the user. In fact, the tape is never seen from the time it is placed in the beginning of the channel at the bottom rear of the unit until it emerges (as if by magic) from the slot at the front. Also, the triangular protrusion used to help tear the paper tape does not work very well because of the slope of the unit front. It leaves very ragged edges which makes it difficult to inset the tape into the reader.

On the other hand, the reader is nicely designed. The long channel is much easier to use, and there is a nice pin strategically placed to hold fan-fold tape. The reader is easy to use and would appear to be highly reliable. The punch mechanism and the solenoid drivers are nicely set up and would appear to provide trouble free service.

On the balance, the Heathkit H10 Paper Tape Reader/Punch is a reasonable cost means of adding reliable paper tape capability to your system; it's not an ASR 33, but then its not $1,500 either.□

CIRCLE INQUIRY NO. 91

The Dumb Terminal lets you put it all together.

With the new, lower-priced Dumb Terminal™ Kit, that is. Pick one up and escape, once and for all, the headaches of scavenged teletypes and jury-rigged TV sets. With just a little time and aptitude, you can have a live and working Dumb Terminal right in your own home, garage, or business. One that lets you get it all out of your system — or into it.

Forget the cheap imitations, with their overblown price tags and interminable lists of options. With the Kit, you can build yourself the same, old basic Dumb Terminal that's been selling over 1500 units a month. With basic, sensible features like a bright 12" diagonal screen. Fifty-nine data entry keys. 1920 characters displayed in 24 rows of 80 letters. Plus 33 positive action switches that let you activate functions like 1 of 11 different baud rates, an RS232C interface, or a 20mA current-loop. And more. Not bad for Dumb.

All you need, besides the Kit, is some initiative, and a few basic tools — a good soldering iron, wire cutters, needle-nose pliers, and one or two trusty screwdrivers. The Dumb Terminal Kit provides you with everything else. Including an attractive cabinet, CRT screen, keyboard, PC board, and all essential electronic components. Naturally, you also get illustrated, step-by-step assembly instructions, not to mention an easy-to-understand operator's manual.

So, if you'd like more input on the Dumb Terminal Kit, just fill out the coupon and we'll send you complete, free information.

Oh, and by the way, just by sending in the coupon, you will be made a charter member of the Dumb Terminal Fan Club. A select organization that will send you your own nifty Dumb Terminal Fan Club Kit, containing: an official certificate of membership; an autographed photo of the Dumb Terminal himself; and a bona fide membership card to prove irrefutably you're "One of Us." (Sorry, limit one kit per person.)

And, if you include a trifling $6.00, you can have your very own Dumb Terminal T-shirt. (No limit at all on these.)

Simply mail the coupon and get the whole assortment. And find out why members of the Dumb Terminal Fan Club are some of the smartest people around.

LSi®

Dumb Terminal. Fun Club.

"Dumb Terminal" is a trademark of Lear Siegler, Inc., E.I.D./Data Products, 714 N. Brookhurst St., Anaheim, CA 92803, (800) 854-3805. In California (714) 774-1010.

Yes, I would like more information about the incredible Dumb Terminal Kit. And don't forget to enroll me as a Charter Member in the Dumb Terminal Fan Club.

Name________________ Title(?)________

Company________________________

Street________________________

City________________ State______ Zip________

Enclosed is $__________ for an official Dumb Terminal T-shirt(s).

Please make all checks and money orders payable to LeAnce & Reiser, OK?

Quantity and size(s) of shirt(s) required: ____S ____M ____L ____XL

Rush this application to: Dumb Terminal Fan Club Headquarters c/o LeAnce & Reiser, P.O. Box 17123, Irvine, CA 92714.

CIRCLE INQUIRY NO. 95

"Jones, perhaps you aren't aware of our success in teaching robots to perform simple tasks such as yours. . ."

Upgrade Your SWTPC System to 60K!

By Earle Hilton

It can be done, and it's possible with or without an expansion chassis.

Your highly reliable M6800 computer is a work horse and can do a lot more than the designers expected, as evidenced by the 32K limit designed into the motherboard and CPU board, although address C000 through DFFF is open for 8K of PROM.

This is memory totaling 40 kilobytes which is a little short of the 65K of addressing available by the M6800 chip. The subject of this article is how to expand your system to a possible 20K, increase the I/O port number to 16, and change the map to 60 kilobytes.

The best solution to the problem would be to install 8K or 16K memory cards. Two 16K RAM boards would fill out the 32K leaving four slots to expand. Another 16K board can be added. A small modification to the CPU module will make address A000 through BFFF available for an 8K, or you can use 16K to extend through addresses C000 and DFFF.

The Smoke Signal Broadcasting people will furnish with their 16K RAM board the details for the MP-A CPU card that will address the first block to A000.

With this, the new total memory is (RAM) 48 kilobytes and fills all addresses 0000 to 7FFF and A000 to DFFF. This is a good size system for SWTPC 6800.

If you wish, you can add an 8K PROM board with a switch in or out PROM monitor. You may also choose to use a different monitor. An example would be the new SWTBUG# or RT68MX from Microware Systems Corporation. The options are unlimited with the P38 series PROM module made by Smoke Signal Broadcasting. They do furnish information to assist you in the necessary change to upgrade your SWTPC 6800.

All this leads up to getting the most from an already excellent and reliable system. If you would believe this is the most we can expect to get from the SWTPC, I have a surprise for you. We can add another 4K of RAM or EPROM to the present total of 56K (kilobytes).

Those who own the Southwest 6800 computer already know that I/O addresses are coded to wrap around all the way to H9FFF. The normal address of the eight ports are H8000 through H801F 32 bytes. These 32 bytes wipe out 8K of possible address space and put a large gap in the memory map. The I/O is interleaved all the way to H9FFF. By this I mean the 32 bytes is alternated every other 32 bytes.

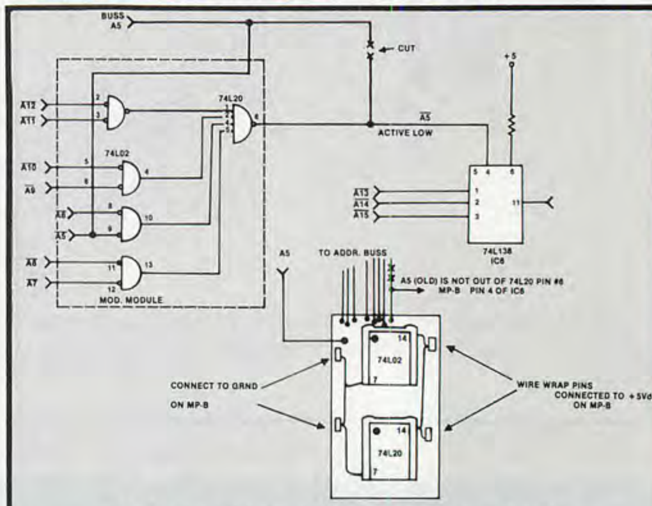
In order to cure the lost memory problem, a number of things must be done. First, we define the address, and determining its boundaries will be a starting point. The SWTPC system defines the I/O area with address lines A15, A14, A13 decoded by IC6 74L138. Also A5 is used as enable LOW at pin 4 of IC6. All this is fine except A12, A11, A10, A9, A8 are not defined. If you wish to do as I did with my SWTPC, you will want to define address lines A12 through A6 low and connect the logic result to pin 4 of IC6 74L138 of I/O decoder on the motherboard. Otherwise you will have wrap around for any bit not defined.

This will allocate 32 bytes only of I/O and free memory from H801F to H9FFF. This is about 8 kilobytes minus 32.

The last total was 56 kilobytes. It's not hard to see that we are over 60 kilobytes and ready to add a 6820 I/O chip and code it for out boarded memory and a Megobyte unit, but that's in the future.

ADVANTAGE GAINED

The advantage is that you may add additional I/O by defining consecutive addresses above 801F. Example: 8020 through 83FF is used by Smoke Signal (SSB) for a ROM bootstrap and interleaved to H83FF very effectively. I set my second I/O port area to H8420 with top port at H843F and in this way I am out of SSB memory allocations, ready for a mini-floppy. For the mod installed, you may option to H8040 to 805F for 8 ports.



(All lines shown at active address box)

HOW TO DO IT

IC6 74L138 pin 4 must be active low to enable the I/O data latch and device decoder IC3 74L138. This makes an easy modification because only one line needs to cut on the foil. The A5 address line coming from the main bus should be cut, then a hole should be drilled next to each side of the line A5. Use a 65# .035 drill bit.

Solder one end of a 6-inch piece of wire to the A5 going to pin 4 of IC6, and do the same to the other side leading to the bus. These wires are fed through to the top of the board and connected to the modification module to be attached to the motherboard.

The two integrated circuits, 74L02 and 74L30 (or 74L20) are mounted on a p.c. board about 1.5 inches wide and made just long enough to accommodate the IC's and 9 off board connection. You may use wire wrap pins for the +5 volts and return connections when mounting the module on the MP-B bd#. Solder the pins to the respective power supply foil (top only).

There are two ways to connect the wire to address bus lines. One which may be more popular is to use a 65# drill bit and make a hole next to or through the proper address line, feed the wire end from the module in the hole and solder.

The other option is, if you are lucky to have an 8 or 16K board in your system and have an empty slot at the rear, use a female board connector and match pins to the correct lines. Solder the wire from module to the terminals, check wiring, and clean up all solder points. Now you are ready for power up check.

Use your memory change function 'M' to test your new address boundaries. □

ADVANCED COMPUTER PRODUCTS

THE FIRST TO OFFER PRIME PRODUCTS TO THE HOBBYIST AT FAIR PRICES NOW LOWERS PRICES EVEN FURTHER!

1. Proven Quality Factory tested products only, no re-tests or fallouts. Guaranteed money back. We stand behind our products.

2. Same Day Shipment All prepaid orders with cashiers check, money order or charge card will be shipped same day as received.

S100 PRODUCTS

LOGOS I 8K STATIC RAM
★ Low Power
★ Selectable Memory Protect
★ Totally Buffered
★ Battery Back-up
★ Address on 1K boundary
★ Requires no front panel
★ No wait states

ASSEMBLED & TESTED
250ns. 199.95
450ns. 179.95

KIT
250ns. 149.95
450ns. 125.95

WE OFFER GROUP DISCOUNTS

Bare PC Board w/Data **$21.95**
Now over 1 year successful field experience
"Special Offer" Buy (4) 8K 450ns. Kits $117.00 ea.

IMS 16K STATIC RAM
★ Memory mapping
★ Phantom
★ Address 16K Bound
★ Use with or w/o front panel
★ Power 2.1 amps typ.
★ Uses 2114
ASSEMBLED & TESTED ONLY
450ns. $439.95 250ns. $495.95

S-100 32K STATIC RAM
★ Address 32K Boundary
★ Power 450ns. 2.8 amps typ.
★ No wait states on 2MHz
★ Fully Buffered
★ Phantom can be added
★ 2114/TMS4045 or 9135

ASSEMBLED & TESTED	KIT
250ns. $849.00	250ns. $790.00
450ns. $799.00	450ns. $740.00

Bare PC Board w/Data $59.95
SPECIAL OFFER:
Kit without Memory only $99.95. Add 2114 Memory for $160.00 per 8K

PARATRONICS LOGIC ANALYZER KIT
MODEL 100A $219.95
(analyzes any type of digital system)
Trigger Expander Model 10 .... $229.00
Baseplate 9.95
Model 10 Manual 4.95
Model 150 Bus Grabber Kit 369.00

DC HAYES DATA COMMUNICATIONS ADAPTER
★ Telephone/TWX ★ S-100 compatible
★ Bell 103 freq. ★ Originate & answer mode
Assembled & Tested $279.95
Bare PC Board w/data .... $ 49.95

Z-80/Z-80A CPU BOARD
★ On board 2708
★ Power on jump
★ 2708 included (450ns.)
★ completely socketed
Assembled and tested $185.00
Kit $129.95
Bare PC Board .... $ 34.95
★ For 4MHz Speed Add $15.00

TDL COMPATIBLE Z-80 CPU
★ Compatible to TDL software & hardware ★ Can be upgraded for 4MHz operation
Assembled and tested $199.95
Kit $139.95
Bare PC Board .... $ 34.95

BYTE USER 8K EPROM BOARD
★ Power on Jump ★ Reset Jump
Assembled & Tested 94.95
Kit 64.95
Bare Pc Board 21.95
Special Offer: Buy 4 kits only $59.95 each
• NOTE: 2708-6 only $5.95

TRS 80 UPGRADE KIT
16K Memory with Jumpers and Instructions $159.95
(Specify Level I or Level II)
APPLE II 16K UPGRADE KIT $149.95

TARBELL FLOPPY INTERFACE
★ S100 Compatible ★ Uses CPM
★ Jumper Selectable ★ Persci,Shugart,etc
Assembled and tested $269.95
Kit $179.95
Bare PC Board .... $ 39.95
NOTE: For CPM Add $70.00 Documentation Add $20.00

PET TO S-100 ADAPTER
Allows Pet to be interfaced to popular S-100 Bus.

Kit $189.95
Assembled $269.95
For Low Cost 8 Slot Bus to expand your Pet only .... $149.95 Kit

MICRODESIGN MR-16 2716 EPROM BOARD (MR-8 Also Available at same price)
★ Individual Prom Address
★ Uses Low cost 16K TI EPROMS
★ Optional 1K RAM ★ Phantom-control
Assembled and Tested 174.95
Kit 99.50

DATABOOKS & MANUALS

NSC TTL Data	$ 3.95	AMI MOS/LSI Data	3.95	Mot. Vol. 4 Mect Data	3.95
NSC Linear Data	4.95	GI MOS/LSI Data	4.95	Mot. Vol. 5 CMOS Data	2.95
NSC Linear APP/note I	3.95	Osborne Intro to Micro Vol. 0	7.50	Mot. Vol. 6 Linear Data	3.95
NSC Linear APP/note II	3.95	Osborne Intro to Micro Vol. I	7.50	Mot. Vol. 9 Schottky TTL	2.95
NSC CMOS Data	2.95	Osborne Intro to Micro Vol. II	7.50	Mot. MPU Applications	25.00
NSC Audio Data	3.95	Osborne 8080 Programming	7.50	Mot. MPU Prog. Ref. Manual	3.95
NSC Volt. Reg. Data	2.95	Osborne 6800 Programming	7.50	Mot. Power Data	2.95
NSC Memory Data	3.95	Osborne Z80 Programming	7.50	Mot. Rectifier Data	2.95
NSC MOS/LSI Data	3.95	TI Powr Semi's Data	7.50	Mot. Switching Tran.	2.95
NSC Power Transistors	2.95	TI TTL Data	6.95	Mot Zeners	2.95
Intel Databook	3.95	TI Transistors & Diodes	6.50	Basic Software SRI Vol. I or II	24.95
Intel MCS85 Manual	7.50	TI Memory Data	3.95	Basic Software SRI Vol. III	39.95
Intel MCS80 Manual	7.95	TI Optoelectronics	3.95	Basic Software SRI Vol. IV or V	9.95
Intel MCS40 Manual	4.95	TI Linear Data	3.95	Basic Software SRI Vol. VI	49.95
AMD 8080 Handbook	5.95	TI Bipolar Memory	3.95	Basic Software SRI Vol. VII	39.95
AMD Linear Data	4.95	TI Interface Data	4.95	1978 IC Master	47.50
AMD Schottky Data	4.95	Motorola Semi Data 1, 2, 3	9.95		

6800 DESIGNER BOARDS MODULES PROTO BOARDS

★ Motorola Compatible Modules*

MEK 6800 D2 Kit	$235.00	AMI EVK 200 Kit	249.95
9600 6800 MPU Module	495.00	AMI EVK 300 Assembled	275.00
9601 16 slot Mother Bd.	175.00	EVK Kluge Board	95.00
9602 16 slot Card Cage	75.00	EVK 16K Byte Ram Board	75.00
9603 8 slot Mother Bd.	99.00	EVK 6 Slot Motherboard	35.00
9604 System Power Supply	250.00	EVK Extender Board	45.00
9610 Prototype Board	36.00	EVK Solid Frame Chassis	129.00
9615 4KEprom Module	250.00	EVK Connectors	6.50
9620 16 port parallel I/O	375.00	AMI 6800 Proto Rom	30.00
9626 8K Static RAM	295.00	AMI 6800 Micro Assembler Rom	30.00
9626K 8K Static RAM Kit	225.00	6800 Tiny Basic Paper Tape	20.00
9630 Extender Card	60.00	6800 Tiny Basic Eprom	125.00
9640 Multiple Tuner Prog.	395.00		
9650 8 port Duplex Asyn. I/O	395.00		
Mot 43/86 Connectors w/wor s/t	5.95		
AMI EVK 99* 6800 sub Kit	99.00		

ZILOG COMPATIBLE BOARDS
Z-80 CPU 395.00
ZDC Disc Controller 395.00
MEM 16/65K Memory 595.00

SUPPORT DEVICES

AM9511 Arith. Processor	$195.00
AM9517 DMA Controller	71.95
AM9519 Universal Interrupt	24.95
3881 (Z80 PIO)	11.25
3881-4 (4MHz)	14.95
3882 (Z-80 CTC)	11.25
3882-4 (4MHz)	14.95
8205/74S138 Decoder	2.95
8212 8 bit I/O	3.25
8214 Priority Int.	7.95
8216 Bus Driver	3.25
8224 Clock Gen.	3.95
8224-4 (4MHz)	9.75
8226 Bus Driver	3.95
8T26 Bus Driver	2.39
8228 Sys. Control	6.95
8238 Sys. Cont.	7.95
8251 Prog. I/O	11.50
8253 Int. Timer	27.95
8255 Prog. I/O	11.50
8257 Prog. DMA	27.95
8259 Prog. Int.	27.95
8275 CRT Controller	125.00
8279 Prog. Keyboard	19.95
6810-1 128 x 8 RAM	4.75
6820 PIA	7.95
6828 Priority Int.	11.95
6834-1 512 x 8 Eprom	12.95
6850 ACIA	7.95
6852 Serial Adapter	9.95
6854/HD46505CRT Contr.	39.95
6860 Modem	14.50
6862 Modulator	17.50
6871A 1.0MHz OSC.	25.95
2350 USRT	9.95
6880 Bus Driver	2.39
1821 SCD 1K RAM	25.00
1822 SCD 256 x 4 RAM	16.95
1824 CD 32 x 8 RAM	9.95
1852 CD 8 bit I/O	10.95
1856 CD I/O	8.95
1857 CD I/O	8.95
6520 PIA	8.95
6522 Mult	9.95
6530-002	15.50
6530-003	15.50
6530-004	15.50
6530-005	15.50
3851 F8 Prog. Store	14.95
3853 F8 Memory I/O	14.95

PROMS

2708	12.95
2708-6	5.95
1702A	4.95
1702A-6	3.75
2716-5V	44.95
2716-5V, 12V	24.95
2758 5V	25.95
5203AQ	11.95
5204AQ	9.95
6834-1	12.95
IM 5610	2.95
82S123	2.95
82S126	4.50
82S129	4.95

RAMS DYN.

4116 16K x 1	18.95
4115 8K x 1	11.95
4050 4K x 1	4.45
4060 4K x 1	4.45
4096 4K x 1	4.25
2104 4K x 1	4.95
2107B-4 4K x 1	4.25
5261	1.95
5262	1.95
5270	4.95
5280	4.95
1103	1.95
4008L	4.95
TMS4070 16K x 1	19.95
4027-3	4.95
MCM6605 4K x 1	4.95

FLOPPY DISK I/O

1771 I/O 8" only	22.95
1771-01 8" & Minifloppy	27.95
uPd372 Nec Floppy	49.95
1781 Dual Floppy	89.95

CHARACTER GENERATORS

RO32513-001 (5V) Upper	9.50
RO32513-002 (5V) Lower	10.95
RO32513-ADM3 (5V) Lower	14.95
MCM6571	10.75
MCM6571A	10.75
MCM6574	14.50
MCM6575	14.50

KEYBOARD ENCODERS

AY5-2376	13.75
AY5-3600	13.75

UARTS/USRTS

TR1602B (5V, 12V)	3.95
AY51013 (5V, 12V)	5.50
AY51014A/1612 (5-14V)	6.95
AY51015A/1863 (5V)	6.95
TMS 6011 (5V, 12V)	5.50
IM6402	9.95
IM6403	9.95
2350 USRT	9.95
1671B Astros	24.95

BAUD RATE GENERATORS

MC14411	11.25
4702	14.95
WD1941	9.95

TV CHIPS

MM5320 TV Synch	7.95
MM5369 Prescaler	3.95
LM1889 Modulator	3.95
CW300 Saw Function	1.50
MM57100 Color TV Game	6.95
MM57104 Clock	3.75
AY38500-1 TV Game	5.95
AY38600 Color TV Game	24.95
AY38615-1 Color Converter	8.95
AY38700-1 Tank Chip	29.95
RF Modulator with Audio	8.95

A/D CONVERTERS

8700	8 bit Binary	13.50
8701	10 bit Binary	22.00
8702	12 bit Binary	36.95
8705	12 bit TS	42.95
9400	Volt to Freq. Conv.	7.25
8750	3-1/2 Digit BCD	13.95
8038	Multifunction	3.95
1408L6	6 bit	3.95
1408L8	8 bit	5.95
DAC01	A/D	5.95

TV INTERFACES

Pixie-Verter	8.50
TV-1 Video Interface	8.95
Pickles & Trout TV Mod. Kit	20.00
Multiverter	35.00
M&R Modulator	35.00

MICROPROCESSORS

Z-80	$21.95
Z-80A	29.95
F-8 (3850)	19.95
2650	24.95
CD1802	19.95
8080A	12.95
SALE 8085	**18.95**
8008-1	14.95
2901	21.95
2901A	29.95
TMS 9900JL	89.95
CP1600	39.95
6502	19.95
IM6100	29.95
6800	**19.95**
6802P	32.95

SOCKETS

8 Pin ww	.32	14 Pin S/T	.20
14 Pin ww	.37	16 Pin S/T	.22
16 Pin ww	.38	18 Pin S/T	.31
18 Pin ww	.60	22 Pin S/T	.35
20 Pin ww	.90	24 Pin S/T	.41
22 Pin ww	.93	28 Pin S/T	.49
8 Pin S/T	.17	40 Pin S/T	.63

CONNECTORS

6 Pin Single S/E	1.49
15/30 Dual S/E	1.95
18/36 Dual S/E	2.35
22/44 Dual S/E	2.95
40/80 W/W	4.95
43/86 Dual W/W/S/T	6.50
50/100 IMSAI W/W	4.75
50/100 IMSAI S/T	4.75
50/100 Altair W/W/S/T	5.95
IMSAI Card Guides	4/1.00

25 Pin-D Subminature

DB25P	3.25
DB25S	3.75
Hood	1.25
Set w/Hood	6.50

NEW CTS DIPSWITCHES
CTS206-4 $1.75 CTS208-8 $1.95
CTS206-5 $1.75 CTS209-9 $1.95
CTS206-6 $1.75 CTS209-10 $1.95
CTS207-7 $1.75

8080 USER'S IT'S HERE
LIVERMORE BASIC
ON 65K ROM
THAT'S RIGHT ON ROM!!!
OUR PRICE only $95.00

PCG PROGRAMMABLE CHARACTER GENERATOR
The hottest version of STARWARS available
S-100 Compatible 2MHz Kit with object code on tarbell or cuts $169.95

NAKED PC BOARD SALE S-100

Z-80 CPU (ITHACA)	34.95
Z-80 CPU (TDL comp.)	34.95
8080A CPU	34.95
8K Static Logos	21.95
8K Eprom Byteuser	21.95
32 Static S-100	59.95
Tarbell Floppy I/O	39.95
Tarbell Cassette	29.95
Vector 8800 Proto	19.95
ACP Proto Bd.	27.95
ACP Extender w/conn	15.95
Realtime Clock	34.95
WMC 13 Slot Mother Bd.	33.00
S-100 8 Slot Mother Bd.	34.95
Vector 8803 11 Slot M. Bd.	29.95
SSM Video I/O	27.95
SSM I02 Parallel I/O	27.95

UV "Eprom" Eraser
Model UVs-11E $59.50
Holds 4 Eprom's at a time.
Backed by 45 years UV experience
Model S-52T $219.95
Professional Industrial Model

ATTENTION KIM USERS
KIMSAI expansion to S-100 125.00 Kit/165.00
KIMSI to KIM Connector 5.75/pair
KIM 1 6502 Single Board Computer 245.00
KIM 1 Power Supply 69.00
KIM Memory Plus - consists of 8K Ram, 8K 2716 Eprom Programmer, I/O etc. 245.00
KIM SOFTWARE
• Please package (cassette) 12 games 16.95
• Hex Editor package (cassette) 16.95
• Help Mailing List pkg. (cassette) 16.95
• Help Info Retrieval pkg. (cassette) 16.95
• Microchess (cassette) 16.95
• Microad Assembly/Disassem/Editor 27.95
• Microad Source Listing (cassette) 27.95
• Tiny Basic for KIM (paper tape) 10.95

ATTENTION PET USERS
BETSI pet expansion to S100 125.00 Kit/160.00
PET Connector Kit includes (4) Connectors for memory expansion, IEEE 488 I/O, cassette I/O and parallel user port 9.95/set

ATTENTION TRS-80 USERS
Now in stock the hard to find 20/40 Memory Expansion Connector with contacts 6.95

ATTENTION APPLE II USERS
APPLE II w/16K (get a spare) $1125.00
416/4116 16K Memory Module 8/200.00
Floppy Disc II w/Controller 495.00
Applesoft II Firmware Card 100.00
Video Monitor II (B/W) 209.00
Printer Centronics Micro 695.00
Printer Centronics 779 1445.00
Apple II Prototype Board 24.00
Parallel Interface Card 180.00
Communications Interface Card 190.00
PR40 Printer I/O w/cassette 49.95
2716 Eprom Burner 89.95
requires 2716 Socket Adaptor 10.00
Apple II to MFE tape I/O 197.50
Convenient Assembler cassette 19.95
Apple II Softech Software Exchange Membership includes 8 pack of cassettes 39.95

All Shipments FCM or UPS. Orders under $100.00 add 5% handling and postage. Orders over $100.00 add 2.5% handling & postage. Mastercharge/Bank americard/COD accepted w/25% deposit. California Residents add 6% tax. Foreign Orders add 8% handling. All parts prime factory tested guaranteed. Same day shipment. Add 25 cents for Data.

Retail pricing may vary from Mail Order Pricing.

STATIC RAM HEADQUARTERS

	1-24	25-99	100
21L02 450ns.	1.30	1.25	1.15
21L02 250ns.	1.59	1.55	1.45
2102	1.25	1.15	1.10
91L02APC	1.75	1.65	1.50
21L11-1	4.10	3.95	3.75
211-1	3.75	3.65	3.55
21L12-1	4.25	4.10	3.95
2112-1	2.95	2.85	2.65
21L01-1	3.95	3.75	3.65
2101-1	2.90	2.70	2.55
2114-3 300ns.	9.95	9.75	8.25
2114-4 450ns.	7.95	7.50	5.50
TMS4044	9.95	9.75	8.25
TMS4045	9.95	9.75	8.25
EMM4200A	12.50	11.95	9.95
EMM4402	7.95	7.25	6.25
5101C-E	7.95	7.95	7.25
upd410 (4200)	10.95	10.25	9.25
AMD9140/41	10.95	10.25	9.25
AMD9130/31	12.95	11.95	10.25
FSC 460/46416K CCD Only $18.95 Each			
1101	1.95	1.75	1.25
P2125/93425 (45 ns.)	7.95	7.35	7.25

WAVEFORM GENERATORS

8038 Function Gen	3.95
MC4024 VCO	2.45
LM566 VCO	1.75
XR2206 Function Generator	5.25

CHARGE COUPLED DEVICES
16K CCD -First time offered Fairchild 460 CCD 16K Memory (now you can experiment with CCD technology at a reasonable price. 17 page Application note supplied with each order. Quantity Limited)
$18.95 each (reg. 43.00)

CRYSTALS
Microprocessor Timebases TV Game

Frequency	Price	Frequency	Price
1.0MHz	$5.85	6.0MHz	$ 4.95
1.8432	4.95	6.144	4.95
2.0MHz	5.85	6.5536	4.95
2.01MHz	2.95	10.0MHz	4.95
2.097152MHz	5.85	13.0MHz	4.95
2.4576MHz	5.85	14.31818	4.95
3.579545MHz	1.50	18.0MHz	4.95
4.0MHz	4.95	18.432MHz	5.95
4.194304MHz	5.95	20.0MHz	4.95
4.91520MHz	5.95	22.1184MHz	5.95
5.0MHz	4.95	27.0MHz	5.95
5.0688	4.95	36.0MHz	5.95
5.7143MHz	5.95	48.0MHz	5.95
		100KC	12.95

DISPLAYS/OPTO

DL 704/707/CC/CA .300	1.25
FND359 CC .357	.95
FND 500/507/CC/CA .500	1.35
FND 503/510 CC/CA .500	.95
FND 800/807 CC/CA .800	2.50
Bowmar 9 digit bubble	.99
FSC 8024 4 digit CC .800	4.95
HP7340 HEX Display	19.95
TIL 305 5 x 7 Array	4.50
TIL 306 7 seg w/logic	8.95
TIL 308 7 seg w/logic	8.95
TIL 309 7 seg w/logic	7.95
TIL 311 HEX Display	12.95
MA 1003 12 auto clock	17.95
MA 1002 4 digit clock module	9.95
MA 1010 4 digit clock module	9.95
NSN 373/374 dual CC/CA .300	2.20
NSN 583/584 dual CC/CA .500	2.60
NSN 783/784 dual CC/CA .700	3.00
4N25 Opto Isolater	1.10
MCT 2 Opto Isolater	.89
4N33 Darlington ISOL	1.75
Red Led's .185 Dia	5/1.00
Green/Yellow	4/1.00
HP 5082/7731 7 seg.	.90

MONTHLY SPECIALS

14 Pin S/T sockets 1000 pcs.	.10
16 Pin S/T sockets 1000 pcs.	.11
22 Pin S/T sockets 1000 pcs.	.12
FSC460/464 16K CCD's	18.95
AMD 9140CDC Static Ram	10.95
4116/416 16K Dynamic Ram's	8 for/149.95
1488 or 1489 RS232 Driver	1.25
8T97 Buffer	1.25
8130 or 8131	2.45
8833 or 8835	1.99
74367 or 74368	6/5.00
75451/52/53	10/2.50
8T26 Bus Driver	2.39
78L05 Regulator	2/1.00
MCT2 Optoisolator	.89
2510A Shift Register	2.95
2519A Shift Register	2.95
MM5056 Shift Register	2.95
LM760N-14 Compartor	1.10
DS0025CN Clock Driver	1.49
DS0026CN Clock Driver	2.50
8T20 Bidirect oneshot	3.49
1403AN Shift Register	1.50
9368	2.95

NEW 1978 CATALOGUE SEND 25¢ POSTAGE

DISCOUNT COMPUTER CORNER

	Discount Cash	Computer Credit Card
Apple II/16K	$1125.00	$1155.00
TEI PT208	4599.00	4699.00
TEI MCS122	450.00	462.00
Cromemco Z-2	536.00	551.00
Cromemco SYS III	5499.00	5561.00
Decwriter II	1475.00	1525.00
Persci 277	1230.00	1266.00
Shugart 800/801	495.00	512.00
Pertec FD200	299.00	319.00
MFE Dual 751	730.00	744.95
Shugart 400	325.00	315.00
Horizon I	1439.00	1479.00
North Star	599.00	617.00
Low Cost S-100 Bus	149.95	155.95
ADM 3 Assem.	829.95	865.00
Sorec IQ 120	895.00	945.00
Teletype Model 43	1199.00	1230.00
AM100	Contact sales desk	
Imsai w/22 slots	599.00	617.00
Diver 2708/16 Programr	275.00	289.00
Pennywhistle Modem	129.95	129.95
Cromemco 16K Ram	449.00	462.00
Hazeltine 1500	1175.00	1195.00
Okidata 110 w/TFR5232	1675.00	1705.00
Okidata 22 w/TFR5232	2705.00	2810.00
MEK 6800 D2 Kit	235.00	Same
KIM I 6502	229.95	Same
Intercept Jr 6100	281.00	Same
Technico 9900 Kit	299.00	Same
RCA VIP Cosmac	249.00	Same
Rockwell AIM	375.00	Same
Synertek VIM-1	269.00	Same

P. O. BOX 17329 Irvine, California 92713 New Phone (714) 558-8813
TWX: 910-595-1565

Retail Store Open Mon. – Sat. Located at 1310 "B" E. Edinger, Santa Ana, CA 92705

ADVANCED COMPUTER PRODUCTS

COMPUTER SPECIALS

WE'VE GOT A TRUCKLOAD COMING!
. . . and it's COLOR
"The Compucolor II"

. . . a personal colorgraphics system for the modern computer man . . .

- ★ Color Graphics 13" Color CRT
- ★ Proven 8080A CPU System
- ★ 16K Extended Disk Basic
- ★ Up to 117* Key Keyboard
- ★ Up to 32K* RAM
- ★ Minidisk Drive 51.2K Bytes/Side

*options

Order your system now and we will include at no cost (2) Programmed Software Diskettes ($39.90 value)

Model 3 with 8K RAM 71 Key Keyboard. **$1395**
Model 4 with 16K RAM & RS232C port plus 71 Key Keyboard. $1795.00
Model 5 with 32K RAM, RS232C and 71 Key Keyboard $1995.00
Options: for RS232 on Model 3 . . . . Add $100.00
101 Key Keyboard . . . . Add $150.00
117 Key Keyboard . . . . Add $225.00
Programmed Diskettes. . . . . $19.95 each
Formatted Diskettes. . . . . 2/$19.95

EXIDY SORCERER™

$895.00

User programmable or use program cartridges. Combines the desirable features of the PET, APPLE and TRS-80 into a complete expandable computer system. If you are a comparison shopper send for comparison chart.

★ INCLUDES:
Keyboard & enclosure totally assembled
90 day Warranty
19.5K BASIC (MICROSOFT)
Video & Cassette Cable
Complete Documentation
★★ S100 Expansion Module . . . . . Add $299.00
★★ Cassette recorder . . . . Add $44.95
★★ Sanyo 9" Monitor . . . . Add $159.95

KIM-1

Now only
$229.95
Regular price $245.00

The KIM-1 6502 Standard Computer System now available off the shelf. Write for complete details and software package.

★★ Power Supply . . . . Add $95.00
★★ Cassette Recorder . . . . Add $44.95
★★ Sanyo 9" Monitor . . . . Add $159.95

VIM-1

"The Ultimate in Single Board Low-Cost Computers" In Stock

$269.00

- ★ KIM-1 Compatible
- ★ 4K ROM Monitor
- ★ 1K Bytes 2114 RAM
- ★ 65K Memory Expansion
- ★ User EPROM 2716

★★ Power Supply . . . . Add $95.00
★★ Cassette Recorder . . . . Add $44.95
★★ Sanyo 9" Monitor . . . . Add $159.95

School & group discounts available.

AIM-1

NEW FROM ROCKWELL INTERNATIONAL

Singleboard Computer
- ★ On Board 20 column alphanumeric printer
- ★ Alphanumeric 20 character display
- ★ Terminal style Keyboard 54 Keys
- ★ 6502 based CPU

w/1K RAM $375.00
w/4K RAM $450.00
Assembler ROM . . . Add $85.00
BASIC Interpreter in ROM . . . . Add $100.00

RCA COSMAC VIP

NEW LOW PRICE **$249.00**
Assembled
Regular price $299.95
w/Sanyo 9" Monitor . . . . Add $159.95

"Now you can afford to experiment using RCA's fine 1802 CMOS CPU."

BALLY ARCADE

Z-80 based expandable to 48K
Color Display BASIC available in ROM Cartridge
8K ROM
AK RAM

$299.95

NORTH STAR HORIZON

Now in stock North Star Z-80 based high-performance computer.

- ★ Z-80 Processor
- ★ Motherboard
- ★ 2 Serial +1 Parallel Port
- ★ 16K RAM

Horizon I . . . . $1439.00 Kit
Horizon II. . . . $1799.00 Kit

PRINTERS

OKIDATA Model 110 w/tractor w/RS232 . . . . $1675.00
OKIDATA Model 22 w/tractor w/RS232 . . . . $2705.00
DECWRITER II w/RS232 10-30 cps $1475.00
DIABLO 1620-3 w/tractor feed. w/Keyboard. $3255.00
DIABLO 1610-3 w/tractor feed $2995.00
IPSI 1622-3 w/tractor feed (diablo compatible). $2995.00
IPSI 1612-3 w/tractor feed (diablo compatible). $2820.00
Centronics 761 (KSR) $1595.00
Centronics 761RO $1495.00
Centronics 779 w/tractor feed . . . $1195.00
Teletype Model 43 w/RS232 . . . $1199.00
TI Model 745 w/upper and lower case $1975.00

FLOPPY DISK'S

Shugart SA400 Minifloppy Disk Drive $325.00
Shugart SA450 Dual Density Minifloppy $375.00
Shugart SA800/801 Diskette Storage Drive $495.00
Shugart SA850/851 Double-Sided Drive $625.00
MFE Mayflower Model 751 Double Density. $730.00
Persci Model 277 Dual Diskette Storage Drive $1230.00
Pertec FD200 Minifloppy Disk Drive $299.00
Calcomp Model 143M Dual Density Drive. $625.00
North Star MDS Minifloppy w/S-100 . . . . $599.00

TERMINALS

SOROC IQ 120 . . . . $895.00
LEAR ADM3 Assembled $829.95
LEAR ADM3 Kit $739.95

Sanyo 9" Monitor. $159.95
Sanyo 15" Monitor. $209.95
Motorola 12" Monitor w/o chassis $219.95
Hazeltine 1500. . . . . $1095.00
Hazeltine 1510. . . . . $1295.00

KEYBOARDS

GEO Risk Model 756 ASCII 56 Key Assembled $67.95
Metal case for Model 756. . . . . $27.00
Clare Pender 62 Key ASCII w/26 Pin and 34 Pin Connector (new surplus supply limited). $54.95
63 Key Unencoded Keyboard $32.95
10 Key Hexpad Unencoded. $11.95

ADVANCED COMPUTER PRODUCTS
P. O. Box 17329 • Irvine, California 92713
1310 B E. Edinger • Santa Ana, California 92705
TWX/TELEX 910 595 1565 • TEL (714) 558-8813

All prices FOB Santa Ana. Please add shipping/handling. For credit card purchase contact for quotation. Complete FREE 1978 Catalogue – send 25¢ for postage.

The good guys still wear white.

Buying a computer is serious business. All computer courses, seminars, lectures, etc, stress one important point; know your needs and know your suppliers, be sure you can rely on them. Khalsa Computer Systems is a retail computer dealership that stresses honesty and integrity, not only as a way to do business, but as a way of life. Wearing white is the reflection of that committment.

We select and stock what we believe to be the finest low cost computer systems for home and business. From the Apple II with colorgraphics at under $1,000 to the AM-100, the best data processing system available under $10,000. We also supply DEC equipment from $15,000 to $100,000 for the ultimate in mini computer power. Our staff can help you evaluate and configure systems that will solve your immediate problems and still allow for future expansion. In our showroom we provide separate booths for each computer system, plus reference books, periodicals, a classroom, lounge and an office oriented demonstration area. Our software group consists of experienced systems analysts and programmers who know how to solve your data processing problems. Our full time service department and field service offers advanced and efficient service and parts to back up what we say and sell.

It's worth the drive to Pasadena to see us. You can rely on us to serve you now and in the future, we're committed to it, it's our way of life.

The people in white; we're the ones you can count on.

KHALSA
COMPUTER SYSTEMS INCORPORATED

Open 12 to 8, Tuesday to Friday
12 to 6, Saturday
Closed Sunday and Monday

500 Lake Avenue, Pasadena, California 91101 (213) 684-3311

Khalsa Computer Systems, Inc. has also been known as the Byte Shop of Pasadena since we opened in 1976.

CIRCLE INQUIRY NO. 86

PHOTO 1

Cutting the Cost of Digital Displays

By R. O. Whitaker

The personal computer often communicates with peripheral devices having digital displays. Encoder chips plus 7-segment digits presently are used to meet the digital display requirement. Substantial cost savings plus an increase in reliability may be realized if "Computer Compatible Digits" are used. Such digits appear on the face of the hobbyist clock shown in Photo 1. White lines are painted on a black background with an LED embedded in each line. The digits may be purchased commercially for 64¢ per digit, or the user may paint them on a faceplate and install the LEDs. The LEDs are driven directly from TTL logic. There is no requirement for an encoder-driver.

Figure 1 shows the weighting of the elements of the triangular digit. Figure 2 shows the digits zero to fifteen. In most cases the zero may be indicated by an absence of the other elements. However, in handwritten material, a definite zero element is generally necessary.

It is a human tendency to be attracted to the lit LEDs — to prefer operation in positive logic. However, only a little practice results in accommodation to negative logic.

The simplicity of interfacing the digit to TTL logic is indicated by Figure 3. The 7490 chip is a decimal counter. The BCD outputs feed to the four resistors and then to the LEDs. The anodes of the LEDs connect to a positive voltage, generally five volts. The resistors limit the current to a safe value — 8 ma is a good figure. The LEDs are lit for zeroes rather than for ones. Operating in "Negative logic" is preferable since TTL can sink 16 ma while outputting a zero, but can source only 1.6 ma while outputting a one. Consequently, the LEDs can be much more brightly lit when operated in negative logic. It is a human tendency to be attracted to the lit LEDs — to prefer operation in positive logic. However, only a little practice results in accommodation to negative logic.

But why use the white line digit? Why not just place the LEDs in a row as has been done since the day computers were introduced? The eye associates an LED with a line more positively than with a position in a horizontal row. A second and far more important advantage of the CCD is realized when data is read from a display and recorded by hand. The CCD's may be handwritten with ease. Dots cannot.

Note the digits zero to fifteen appearing in Figure 2. Practice writing them. Use the high dot for a zero. You will find that the pencil must be raised from the paper for only the six and the eleven. If you confuse a two with an eight (or a one), include the zero dot at the top of the "two". If you confuse the three with the nine, slope both lines of the three downward and to the right. If you confuse the ten with the nine, slope both lines of the ten downward and to the left.

But why not use conventional Arabic digits when recording data from such a display? You may. In fact, conventional characters must be used if you are using a conventional typewriter. If the data is hexadecimal, use of the CCD prevents confusion which may result from letters of the alphabet in conventional HEX notation.

A more important reason for recording data in CCD's is that elements in the display digit are directly associated with elements in the written character. The mind need not bother with an interpretation process.

A third reason is of far greater import. If you use some care in positioning the digits (and include a zero dot in every digit), the data you record may at a later time be fed to a computer via a very simple reader. The reader may be a matrix of just five photocells — no character recognition system or program required. The cells are positioned relative to each other such that then the fifth cell is over a zero dot, the other four cells are over respective lines of the digit. The matrix of cells scans a row of digits from left to right. When the fifth cell sees a zero dot, the other four cells are interrogated. Their outputs form an appropriate computer word for representing the digit scanned.

SUBSCRIPTION APPLICATION FORM

PAYMENT MUST ACCOMPANY FORM

SUBSCRIPTION FEE per year: $14.00 U.S.; $16.00 Canada/Mexico; $24.00 Foreign.
Must be in U.S. funds drawn on a U.S. bank.

Make check payable to:

INTERFACE AGE™ **Magazine**
P.O. Box 1234, Cerritos, CA 90701

Name ____________ Title ____________

Company ____________

Home Address ____________

City ________ State ________ Country ________ Zip ______

Date ____________ Signature ____________

☐ CHECK ☐ MONEY ORDER ☐ American Express ☐ master charge ☐ VISA

Account # ____________ Expires ____________

PLANNING TO MOVE?

Let us know 8 weeks in advance so that you won't miss a single issue of INTERFACE.

Attach old label where indicated and print new address in space provided. Also include your mailing label whenever you write concerning your subscription. It helps us serve you promptly.

If you have no label handy, print OLD address here.

Please print

Name ____________

Company ____________

Address ____________

City ________ State ________ Zip Code ________

Affix Label **Print NEW address here**

Name ____________

Company ____________

Address ____________

City ________ State ________ Zip Code ________

MAIL COMPLETED CARD TO:

INTERFACE AGE™ **Magazine**

P.O. Box 1234, Cerritos, CA 90701

Place Stamp Here

INTERFACE AGE™ Magazine

P.O. Box 1234

Cerritos, CA 90701

Place Stamp Here

INTERFACE AGE™ Magazine

P.O. Box 1234

Cerritos, CA 90701

You may care to do some arithmetic using CCD's. You will find that some operations become trivial — like the adding of 2 and 4. Write the two line, then add the four line to it. The result is a six. No thought required.

Now for some practice.

1. If you were to procure a set of drills sized as indicated in Figure 4 (hexadecimal inches), for what sizes would you ask the storekeeper?
2. Identify the historical dates (given in decimal) appearing in Figure 5.

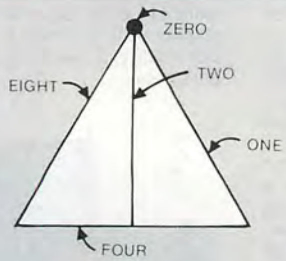


Figure 1. Weighting the Elements of the CCD.

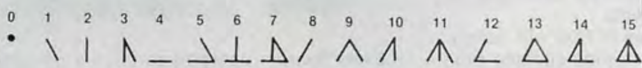


Figure 2. The Digits Zero to Fifteen.

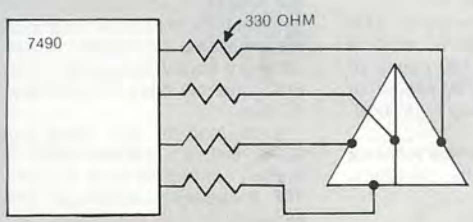


Figure 3. Driving the CCD from a TTL Counter.

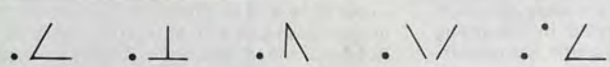


Figure 4. Some Common Drill Sizes Given in Hexadecimal CCD Notation.

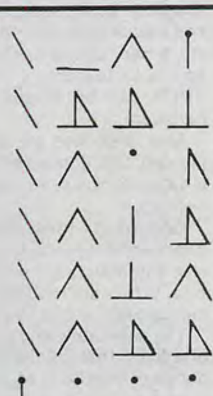


Figure 5. Some Historical Dates Given in Decimal CCD Notation.

If you have the dates correctly identified, a schematic and parts list for the clock will be forwarded to you. Write to R. O. Whitaker, 4719 Squire Drive, Indianapolis, IN 46241.□

NEW PRODUCTS

Program Development System

The powerful PDS assembly language development system is available for 8080 or Z80 microcomputers with at least one disk drive. PDS includes an interactive assembler/editor, a relocating macro assembler, a relocating linking loader, a string-oriented text editor, and a trace debugger/disassembler/monitor. PDS features full Z80 capability while remaining fully operational on any 8080 machine.

The assemblers favor the INTEL instruction mnemonics, treating the Z80 superset as a logical and syntactical extension. The debug module features breakpoint or single-step execution of programs, with trace display of all register contents, flag status, a memory window, and the mnemonics of the instruction just executed and the next instruction to be executed. PDS supports modular program development: large programs can be developed in easily manageable segments.

While the many features of PDS will satisfy the demands of the most sophisticated programmer, PDS affords an exceptional educational environment for beginning assembly language programmers. The interactive combination of the ASMB editor/assembler and the DEBUG trace program allows the user to witness operation of his program.

Versions of PDS are available on diskette for the North Star DOS or Micropolis MOD II MDOS, ready to run with over 100 pages of documentation, for only $99. A CP/M version of PDS, without the relocation feature, is available on 8" diskette for $75.

To order or for more information contact Allen Ashley, 395 Sierra Madre Villa, Pasadena, CA 91107, (213) 793-5748.

CIRCLE INQUIRY NO. 122

Micro Business Software Package

A powerful, general business software package, developed especially for retail computer dealers and OEMs interested in marketing small business computer systems, has been introduced by DeMarco Shatz Corporation, specialists in mini/micro software and systems.

The software package, GBS-1000, is compatible with all major microcomputer systems including 8080 and Z-80 based systems. It is written in OPUS/THREE, a newly developed extended stack-oriented form of BASIC that has features to eliminate repetitive programming tasks.

Functions of the GBS-1000 include inventory control, sales entry, accounts receivable, accounts payable, purchasing, general ledger and maintenance of data files.

For prices and more information contact DeMarco Shatz Corp., 952 Manhattan Beach Blvd., Manhattan Beach, CA 90266, (213) 545-4539.

CIRCLE INQUIRY NO. 123

Seven-X is Flexible and Expandable

The ECD SEVEN-X microcomputer system is a display processor which easily handles formats of up to 132 columns, permitting direct display of line printer oriented data. Software can modify, in real time, virtually every display parameter.

Every system operates through a powerful central system bus which can support up to 12 displays and 16 fully independent processors. A single stack can hold up to 1 megabyte of RAM.

The basic system consists of one 16K central processor, one display processor and one general I/O and system support board. Also furnished are a power supply, one expansin slot, a software library, keyboard, universal serial I/O, multi-channel 8-bit A/D and D/A, and external I/O bus.

Less monitor and mass storage options: $3900. Delivery is 30 days ARO. For more information contact Richard Eckhardt, ECD Corp., 196 Broadway, Cambridge, MA 02139, (617) 661-4400.

CIRCLE INQUIRY NO. 115

6800 Disk Operating System

SDOS is a Disk Operating System for 6800 microprocessors with at least 32K of RAM and floppy (or other) disk drive. SDOS can support 64K RAM and any number or mixture of disk drives on-line.

SDOS provides a friendly environment for application software or development tasks. It supports both random (accessible to the byte) and sequential disk files, device independent I/O, a user customizable command interpreter, and easy tailoring of the disk drivers so that SDOS can be adopted to virtually any disk hardware.

New disk files are created automatically as needed. SDOS does all space management on a dynamic basis, so files can grow or shrink as desired.

Command files allow pre-packaged sequences of keyboard commands to be executed automatically, without operator intervention. Errors are reported to the user by English messages instead of cryptic numbers.

The assembly language interface to SDOS is precisely that of the Software Dynamics I/O package interface, so that all available SD software can be run under SDOS without change.

Versions of SDOS are now available for Midwest Scientific Instruments, Cincinnati Milacron Model 20, Electronic Product Associates Micro-68, and Wavemate 6800 systems. Several other 6800 computer systems should have versions of SDOS available soon.

For more information contact Software Dynamics, 17914 S. Laurelbrook Pl., Cerritos, CA 90701, (213) 926-6492.

CIRCLE INQUIRY NO. 116

Xitan Now Marketing XDB*

Xitan's new software Disk BASIC (XDB) interpreter, for use with Z-80[6] microcomputers using a CP/M[7] disk operating system in at least 32K of memory provides a wide range of functions and commands to build a powerful and highly flexible system for businesses, scientific, engineering or personal computing applications.

Beyond the features found in most BASIC software interpreters, XDB will support a console, reader, punch printer and multiple disk files. Through the use of LOAD GO commands, XDB permits program chaining and program overlay operations. The TRACE function provides a visual display of lines as they are executed to simplify the program debugging.

XDB with faster program execution also supports additional mathematical functions LOG10, FIX, PI and EE; additional string functions; XDB allows the programmer to intercept error conditions; global editing of a BASIC program; use of a PRIVACY statement to protect proprietary source programs. Files may be opened in I/O sequentials, Random Access or Update modes. All devices are supported in single byte I/O.

Using only 18K XDB is able to provide for a growing set of capabilities.

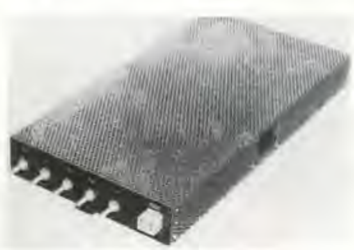
XDB comes complete with a user's manual and is priced at $159.00. For more information, contact Judy Goodman, Xitan, Inc., 1101-H State Rd., Research Park, Princeton, NJ 08540, (609) 921-0321.

*XDB is a registered trademark of Xitan.
[6]Z-80 is a registered trademark of Zilog.
[7]CP/M is a registered trademark of Digital Research.

CIRCLE INQUIRY NO. 126

KS300 Series

The new KS300 series of triple output power supplies are designed for the most demanding of small computer applications. Everything is provided: power fail, clock signal, and sequencing of output voltages.



The three output voltages are fully regulated for line and load variations within ±0.2%. All are fully protected by current foldback, overvoltage protection, and overtemperature protection.

A unique feature of the KS300 is the programming circuitry which will not allow the +12 (or the +15) converter to turn on until the +5 output is above 4.5 volts, thus assuring that the computer logic is on before peripherals or memory.

Price is $428.00 in 100 quantities with three standard models currently available. For more information contact Digital Power Corp., 2060 The Alameda, San Jose, CA 95126, (408) 946-2820, Claude Adkins.

CIRCLE INQUIRY NO. 127

Z BUG is Coming

Z Bug is Xitan's dynamic software debugging utility. When used with Xitan's Macro Assembler, Z Bug provides powerful versatile techniques for developing assembly language programs.

Z Bug extends the standard debugging tools of memory, register examination and breakpoints by adding user-controlled data formatting, highly flexible trap capabilities with tracing and powerful expressing evaluation of user-entered data.

Z Bug can be used as a debugging tool after learning a few simple commands. Its real versatility, however, lies in its ability to be loaded as "high" as possible to leave maximum memory space for the user's program as well as Z Bug's ability to evaluate Boolean expressions and to utilize expressions as arguments.

Z Bug is designed for use with a Z-80* CPU microprocessor such as Xitan's Alpha series microcomputers and under a CP/M[*] disk operating system. Z Bug currently requires 13.25K bytes including data areas.

Z Bug comes with an operating manual, which includes a full section on exploring advanced ideas and Z Bug capabilities, at a price of $89.00.

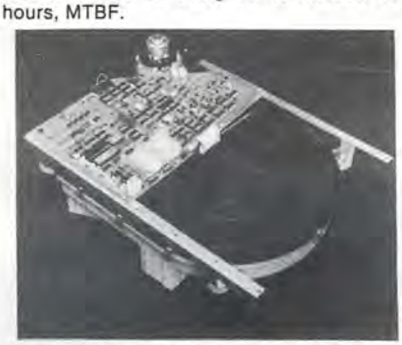
For more information contact Judy Goodman, Xitan, Inc., 1101-H State Rd., Research Park, Princeton, NJ 08540, (609) 921-0321.

*Z-80 is a registered trademark of Zilog
[*]CP/M is a registered trademark of Digital Research

CIRCLE INQUIRY NO. 120

Low Cost Rigid Disk from CalComp

The Marksman is a 20 MB, single-platter Winchester technology disk drive. The combination of Winchester-type technology for high performance with floppy disk techniques for low cost provides for significant benefits in terms of service life and reliability. No preventive maintenance is required for Marksman and the drive is designed to exceed 8000 hours, MTBF.



Marksman comes standard with a VFP data separator. It is power supply compatible with floppy disk systems and has provision for the mounting by customer designed formatters and controllers.

Marksman is priced under $1,300 in OEM quantity. For more information contact CalComp, Inc., 2411 W. La Palma Ave., Anaheim, CA 92801, (714) 821-2541.

CIRCLE INQUIRY NO. 121

Auto-Answer Auto-Dial Modem

An auto-answer, auto-dial, low-speed modem for the Digital Equipment Corporation LSI-11, LSI-11/12, and PDP-11/30 computer families is available from Nortek, Inc.

The complete system, contained on a "dual width" board, provides computer controlled answering and origination of data communication functions, when used in conjunction with a Telco "CBS" type DAA unit. Software selectable baud rates include 110, 134.5, 300 and 600 baud. Number of data bits and parity are also software selectable, enabling use with most available data communications terminals. Emulating a DEC DLV-11E serial interface, the modem is software transparent to the RT-11 V3 and TSX operating systems, when used in auto-answer mode.

Typical applications include remote time-sharing and data entry, automated data collection and reduction systems, store and forward communications systems, and intelligent terminals.

The basic unit includes interconnecting cable for the DAA, software for an auto-dialing "device handler", and is priced at $650.00. Additional software is available for intelligent terminal use. OEM inquiries are invited. For more information contact Nortek, Inc., 2432 NW Johnson, Portland, OR 97210.

CIRCLE INQUIRY NO. 111.

Boards . . . or Complete Systems

The best price and delivery is from MiniMicroMart!!!

CROMEMCO SYSTEM 3 (order as 02-5503-0) List $5990 . . . OUR CASH PRICE $4999

Features 4 MHz CPU, 32K of RAM, dual PerSci 8" floppy disk drive (and provision for installing two additional drives), RS232C Interface, Printer Interface; assembled and tested, ready to use.

CROMEMCO SYSTEM 2 (order as 02-5502-0) List $3990 . . CASH PRICE **$3390**
MODEL 3100 CRT TERMINAL (order as 02-7500-0) List $1595 . . . . . **1350**
MODEL 3703 LINE PRINTER, 180 cps bidirectional (order as 02-7400-0) List $2995 . . . . . **2545**

CROMEMCO DISK SOFTWARE

BASIC, Fortran, Assembler, Cobol, Word Processing System, Data Base Management, all complete with CMOS disk operating system, List $95 each . . . . . **$80 ea.**

	CASH PRICE
Z-2 Computer System, Kit for rack mounting, Z-80 processor, 21 slots, power supply, front cover panel List $595 (order as 02-5301-0)	$499
Assembled and Tested, incl. fan and all edge connectors List $995 (order as 02-5401-0) List $995	845
Z-2D Disk Computer System, Kit Similar to Z-2, but comes with floppy disk controller, DOS, and minifloppy disk drive. A complete system with the addition of a RAM Board (02-5302-0) List $1495	1270
Assembled/Tested (02-5402-0) List $2095	1780

CROMEMCO BOARDS

4 MHz Single Card Computer, Kit (order 02-3511-0) List $395	335
Assembled/Tested (02-4511-0) $450	382
16K RAM Card with Bank Select, Kit (order 02-3216-0) List $495	399
Assembled/Tested (02-4216-0) $795	599
Bytesaver PROM Board and PROM Programmer, Kit without PROM (order as 02-3308-0) List $145	123
Assembled/Tested (02-4308-0) List $245	208
TU-ART Digital Interface, Kit (order as 02-3440-0) List $195	165
Assembled/Tested (02-4440-0) $295	250
Disk Controller Card, Kit (order as 02-3701-0 List $395	335
Assembled/Tested (02-4701-0) $595	515
TV Dazzler, Kit (02-3501-0) List $215	182
Assembled/Tested (02-4501-0) $350	297

Multiple User Basic Now Available!

NORTH STAR

HORIZONS

	CASH PRICE
Horizon 1 Kit List $1599	$1349
Assembled/Tested List $1899	1599
Horizon 2 (w/2 drives) **Kit** List $1999	1699
Assembled/Tested List $2349	1939
4 MHz Z-80 CPU Board, Kit $199	169
Assembled/Tested List $259	209
16K Dynamic RAM Board, Kit (order as 01-3216-0) List $399	329
Assembled/Tested (01-4216-0) $459	379
Complete Minifloppy Disk System w/BASIC and drive, Kit List $699	589
Assembled/Tested List $799	689

TERMINALS

Hazeltine 1500	$1049.95
Soroc 120	849.95
Lear Siegler ADM3A	849.95
Intertube®	784.00

DYNABYTE

	CASH PRICE
57 Naked Terminal Assembled/Tested (order 03-4500-0) List $350	$280
16K Static RAM Module, 250ns (order as 03-4216-2) List $555	444
Less Write Protect (03-4216-1)	359
32K Static RAM Module, 250ns (order 03-4232-2) List $995	796

MICROPOLIS

1041 MacroFloppy® in enclosure (order as 04-7701-0) List $695	625*
1042 MacroFloppy® w/case and AC power supply (04-7702-0) List $795	709*
1053 Dual MetaFloppy® (Order as 04-7705-0) List $1895	1695*

* power source and regulator board required.

OTHER MEMORY BOARDS

Morrow 16K Static Board, 450ns Kit (order 08-3216-0) List $299	$264.00
Seattle 16K Static Board, 450ns, Assembled/Tested (order 33-4216-4) List $375	299.95
SD SALES 32K Dynamic w/32K, Kit (10-3232-0) List $475 super special	389.00

15% OFF ON ALL TDL

Write for information on adapters and accessories for TRS-80 and Heath H-8.

For shipping, add $2 for boards, $5 for floppy disk systems, $10 for Horizons, $15 for Cromemco Z-2 and Z-2D Kits. Assembled Cromemco systems are shipped freight collect.

Above prices subject to change without notice.

WRITE FOR FREE CATALOG.

MiniMicroMart, Inc.

1618 James Street, Syracuse NY 13203
Phone (315) 422-4467

Automatic Data Error Corrector

The ACCUCOM 9100 is an automatic data error corrector that detects and corrects 99.999% of all possible errors caused by channel noise, line dropouts, and modem loss of synchronization.

Error correctin is accomplished by retransmitting all erroneous data blocks, utilizing a unique algorithm. Data throughput is continuous with interruptions only to retransmit data blocks received in error. The Accucom 9100 is installed on 4-wire, full-duplex, synchronous data transmission channels and operates at speeds up to 9600 bps.

Price is $2,420. Delivery is 30 days ARO. For more information contact International Data Science,s Inc., Marketing Dept., 7 Wellington Rd., Lincoln, RI 02865, (401) 333-6200.

CIRCLE INQUIRY NO. 119

High Power, Compact Switching Regulator Power Supply

The PM2498 is a line of low-voltage, high power, high current switching regulator power supplies rated up to 1.5KW and are ideal for large computers and test applications.

The PM2498 Series provides a wide range of outputs from 5 volts at 300 amperes to 48 volts at 32 amperes. The unit has the ability to ride through complete drop-out of the AC input power for 30 milliseconds.

Up to 10 or more PM2498's can be paralleled to obtain 15,000 watts or more of well regulated power.

For more information contact Arnold Hagiwara, Pioneer Magnetics, Inc., 1745 Berkeley St., Santa Monica, CA 90404.

CIRCLE INQUIRY NO. 117

Realist Develops New Screen for Portable Viewer

The new screen, developed for the Agent — newest portable microform viewer from Realist — increases image contrast and definition. The high gain screen was designed for maximum clarity and readability of the front-projected image.

The Agent is one in a series of four new Realist portable viewers which project a large, easy-to-read image which can be viewed by several people. The small rechargeable battery pack allows the portables to be used anywhere even in the most remote locations.

Priced from $96 to $179, the portable readers are being marketed through Realist Microform Products dealers. For more information contact Realist, Inc., N93 W16288 Megal Dr., Menomonee Falls, WI 53051, (414) 251-8100.

CIRCLE INQUIRY NO. 114

Special Cassette for Special Programs

Special programs that need to be the first one on the cassette can be saved on a Program 1 cassette. This cassette, designed for personal computing, contains four minutes of high quality audio tape on each side and comes inside a protective holder.

The user of a personal computer requiring cassette storage, such as the SOL, the PET, the APPLE and the Radio Shack, can now save one or two important programs on each side of a cassette without paying for or wasting the tape in the middle.

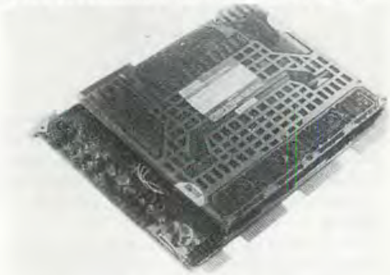
Suggested retail is 98 cents at better computer stores or by mail from The Computer Corner, 200 Hamilton Ave., White Plains, NY 10601.

CIRCLE INQUIRY NO. 113

CIRCLE INQUIRY NO. 98

New Core Memory for Microprocessor Applications

Electronic Memories and Magnetics has available a core memory system designed to interface with National PACE in applications such as programmable process controllers, where non-volatile memory is required.



The Micromemory 3800 is an 8K x 16 random access core memory system. It is complete with timing, control, decode drive circuitry, and address/data registers on an 8½"x11" printed circuit card.

Single unit price for the Micromemory 3800 is $850 with substantial OEM discounts available. For more information contact Joseph Ryan, Electronic Memories & Magnetics Corp., 12621 Chadron Ave., Hawthorne, CA 90250, (213) 644-9881.

CIRCLE INQUIRY NO. 110

Use of a Logic Analyzer to Debug a Microprocessor

An example of how to use a logic analyzer to debug a microprocessor-based process control system is presented in an application note now available from Tektronix.

Two common problems in debugging such systems are described in the four-page note. One considers an interface fault and the other an intermittent system input error.

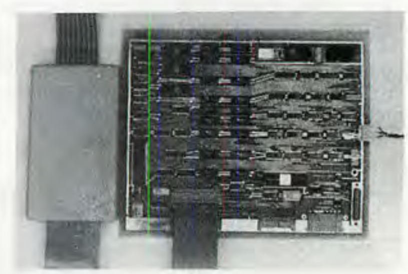
The applications note points out that efficiency, speed, accuracy and throughput of process control systems can be increased *dramatically by implementing microprocesor* control. But both the design and debugging of such systems can be time-consuming with as much as 50% of that time spent debugging the prototype. A logic analyzer can considerably reduce time and effort in design, debugging and troubleshooting such digital systems.

For a copy of the application note "Debugging a Microprocessor-Based Process Control System," contact Tektronix, Logic Development Products, P.O. Box 500, Beaverton, OR 97077, (503) 644-0161.

CIRCLE INQUIRY NO. 124

Hardware/Software Debug System

DB/65 is a stand-alone debug system for the MOS/technology, Synertek and Rockwell 6500 microprocessor family. The PROM resident DB/65 monitor includes hardware breakpoint, eight software breakpoints, an infinite number of real-time software breakpoints using the 'BRK' instruction, symbolic disassembly of user program, program trace of instructions and registers, scope synch output, single step, and a software stack of instruction addresses.



DB/65 comes with 2K of static RAM with sockets for an additional 6K of RAM. The board will support any standard RS232C or current loop terminal with speed range of 110 to 9600 baud. If a current loop terminal is used, only a single +5 power supply is needed.

DB/65 is priced at $1450 with delivery stock to 60 days. Volume discounts are available. For more information contact Mike Corder, Computer Applications Corp., 413 Kellogg, Ames, IA 50010, (515) 232-8187.

CIRCLE INQUIRY NO. 125

A Z-80* Linker Program

Xitan's Linker is a utility program which enables the user to effectively bind individually compiled modules into a single program that may be loaded and run by a CP/M® disk operating system.

Linker provides the ability to pull pre-compiled modules from disk files or "libraries," even if written in different languages and combines them into a single program. When used this way or in a debugging module linking is faster than re-compiling.

Linker features include assigning an absolute memory address to each statement within a module; any code in each segment is relocatable so it will execute at the address to which it is assigned; Linker may be used in a SUBMIT file. Each separately compiled module, after linking process may access code and data defined in other modules; special reports can be obtained to secure Memory Map or memory addresses assigned to modules, segments or symbols.

Linker program is easy to use and can be run on a Z-80 CPU microprocessor, such as the Zitan Alpha Series. Linker, with a user's manual which includes hints for use with a Z-80 assembler, is priced at $69.00.

For more information contact Judy Goodman, Zitan, Inc., 1101-H State Road, Research Park, Princeton, NJ 08540, (609) 921-0321.

*Z-80 is a registered trademark of Zilog

®CP/M is a registered trademark of Digital Research

CIRCLE INQUIRY NO. 112

PLACE ORDERS TOLL FREE: 800/262-1710 inside California 800/421-5809 all other states

21L02 (350ns) Static Rams 120 @ $1.00 ea.	1702A E-PROM $4.75 ea.	6502 Microprocessor 5 @ $11.00 ea.	2708 (450ns) E-PROM 8 @ $7.50 ea.	21L02 (250ns) Static Rams 100 @ $1.25 ea.	Z-80A Microprocessor 5 @ $25.00 ea.
Z-80 Microprocessor 5 @ $20.00 ea.	MM5257 lo pw repl. TMS4044 8 for $8.00 ea.	2114L (250ns) 8 for $8.25 ea.	TMS 4044 (250ns) 16 @ $8.00 ea.	4200A (200ns) Static Rams 25 @ $10.00 ea.	4116 (200ns) 16K Dyn. Ram 8 @ $20.00 ea.

MICROPROCESSORS

F8	16.95
Z80	20.00
Z80A	25.00
1802	19.95
2650	24.95
AM2901	22.95
6502	10.95
6800	17.95
6802	24.95
8008-1	12.00
8035	22.00
8080A	9.95
8085	27.00
8748	60.00
TMS9900	67.00

8080A

SUPPORT DEVICES

8212	3.00
8214	8.50
8216	3.75
8224	3.50
8224-4	9.95
8226	3.95
8228	7.95
8238	7.50
8251	8.75
8253	20.95
8255	11.00
8257	19.95
8259	19.95
8275	75.00
8279	20.00

6800 SUPPORT

6810P	4.95
68B10P	6.00
6820P	7.50
6821P	7.50
6828P	11.25
6834P	16.95
6850P	9.75
6852P	11.75
6860P	10.00
6862P	14.50
6871P	28.00
6875P	8.75
6880	2.00

CHARACTER GEN.

2513 U/L	6.75
2513 (5v) U/C	9.75
2513 (5v) L/C	10.95
6571	10.95
6571A	10.95
6574	13.25

DYNAMIC RAMS

416D (200ns)	20.00
4116 (200ns)	20.00
2104/4096	4.00
2107B-4	3.95
TMS4027	4.00
TMS4050	4.00
TMS4060	4.50
4096	4.00
MM5270	4.50

PROMS

1702A	5.00
2516 (5v)	50.00
27.08	9.00
2716 (TI)	30.00
2716 (INTEL)	50.00
2758	26.60

STATIC RAMS

	1-63	64 up
21L02 (450ns)	1.50	1.18
21L02 (250ns)	1.75	1.50
410D	10.00	8.50
2101-1	2.95	2.50
2102	1.25	.90
2111-1	3.25	2.65
2112-1	2.75	2.35
2114 (300ns)	10.00	8.25
2114 (450ns)	9.00	7.69
2125L	11.00	8.30
TMS4044 (250ns)	8.95	8.00
TMS4044 (450ns)	8.20	7.40
4200A	10.00	8.60
TMS4045 (250ns)	8.95	8.00
TMS4045 (450ns)	8.20	7.40

FLOPPY DISC CHIPS

1771B-01	39.95

KEYBOARD ENKODERS

AY-5-2376	12.75
AY-5-3600	13.75

SHUGART 801R

8" FLOPPY DISC DRIVE.

$550.00

KIM — 1

Assembled and Tested

$245.00

MEMORY PLUS

for KIM—1

8K RAM (21L02)
8K EPROM
ASSEMBLED & TESTED

$245.00

THE APPLE II COMPUTER

One of the best "Total Package" home and business computers on the market. "Basic" in ROM, Color Graphics, Floating Point Basic Package, etc.

16K version only **$1,095.00**

416D 16K x 1

Dynamic Ram Chip can be used for expanding Apple II Memory or the TRS-80 (200ns)

8 for **$20.00**ea.
16 for **$18.00**ea.

Call for quote on larger quantities

full ASCII PROFESSIONAL KEYBOARDS

* Full 128 Character ASCII
* Tri-Mode MOS Encoding
* MOS/DTL/TTL Compatable Output
* Two-key Rollover
* Level and Pulse Strobe
* Shift and Alpha Lock
* Selectable parity
* Positive or Negative Logic.

MODEL 756 (56 keys)

PRICING INFORMATION

Model 756 (assembled)	$59.95
Model 756K (kit)	$49.95
Model 702 enclosure	$29.95
Model 710 numeric pad	$9.95
Model 756MF Mtg.Frame	$8.95

MOTHER BOARDS - S100 STYLE

9 slot "Little Mother"	$35.00
Assembled and Tested	$75.00
13 slot with front panel slot	
Bare board	$35.00
Kit	$70.00
Assembled & Tested	$110.00
22 slot Assembled & Tested	$149.95

CONNECTORS

DB-25P $2.25 DB-25S $3.25

COVER $1.50

44 Pin - PC & EYE	$1.95
44 Pin - WW	$2.50
86 Pin - (6800) PC	$5.00
86 Pin - (COSMAC ELF) PC	$5.00
100 Pin - (Altair) PC	$4.50
100 Pin - (Imsai) WW	$4.25
100 Pin - (IMSAI) PC	$3.25

MODEL 801R Shugart Disc with Cabinet

Includes Cabinet, Disc Drive, Power Supply, Cable, Fan & Data Cable. Has AC line filter.
Cabinet size 10"H x 10"W x 16"D
MODEL DM 2700-S **$750.00**

FLOPPY DISC INTERFACE

JADE Floppy Disc (Tarbell Board) KIT **$175.00 ea.**

S.D. Computer Products Versa Floppy Kit **$149.00 ea.**
Assembled & Tested **$189.00 ea.**

STATIC RAM BOARDS ASSEMBLED & TESTED

8K

Ram 8 (250ns)	$169.95
Ram 8B (450ns)	$139.95
250ns KIT Mem-1	$169.95
450ns KIT Mem-1	$125.00
BARE BOARD	$25.00

16K Uses 2114 (lo pwr.)

Ram 16 (250ns)	$375.00
Ram 16B (450ns)	$325.00
MEM-2 Kit (250ns)	$285.00

32K Assembled & Tested by SEALS ELECTRONICS

JG-32 (250ns)	$795.00
JG-32B (450ns)	$725.00
250ns KIT	$575.00

6800 Adapter - adapts Mem-1 8K board to Motorola MEK 6800D2 evaluation kit.

16K STATIC BOARD

with memory management can be used with Alpha Micro or Cromenco Systems. ASSEMBLED & TESTED

RAM 65 (250ns)	$390.00
RAM 65B (450ns)	$350.00

E-PROM BOARDS

MR-8 (8K uses 2708) KIT with 1K RAM	$99.50
MR-16T (16K uses 2716) KIT with 1K RAM	$99.50
EPM-1 (uses up to 4K of 1702)	$59.95
RAM/N/ROM (16K uses any E-PROM) KIT	$117.00
JG-8/16 (uses 2708 or 2716) KIT	$59.95
BARE BOARD	$30.00

EXPANDABLE E-PROM — S.D. Computer Products
16K or 32K EPROM $49.95 without EPROM

Allows you to use either 2708's for 16K of Eprom or 2716's for 32K of EPROM.

COMPUTER MAINFRAME

Includes: **$295.00**
Power Supply +8v at 18amps ±16v at 2 amps
Mother Board - 12 slots with connectors Assembled & Tested
Has Whisper Quiet Fan & AC Line Filter
Cabinet size 7"H x 19"W x 22" D

DYNAMIC RAM BOARD

by S. D. Computer Products

On board refresh is provided with no wait states or cycle stealing required. +8 VDC 400MA DC, +18 VDC 400MA and -18 VDC 30 MA DC.

EXPANDABLE 32K uses 4115 (2oons)

8K Kit	$151.00	24K Kit	$325.00
16K Kit	$240.00	32K Kit	$400.00

EXPANDABLE 64K uses 4116 (200ns)

16K Kit	$250.00	48K Kit	$675.00
32K Kit	$475.00	64K Kit	$875.00

JADE 16K DYNAMIC KIT uses 4096 (300ns) **$200.00**

JADE Z80 KIT

with PROVISIONS for ONBOARD 2708 and POWER ON JUMP

(2MHZ)	$135.00ea.
Assembled & Tested	$170.00ea.
(4MHZ)	$149.95ea.
Assembled & Tested	$184.95ea.
Bare Board	$35.00ea.

JADE VIDEO INTERFACE KIT

KIT	$99.95
Assembled & Tested	$139.95

S-100 Bus compatible
32 or 64 Characters per line - 16 lines
Graphics (128 x 48 matrix)
Parallel & compositive video
On board low-power memory
Powerful software included for cursor, home, EOL, Scroll Graphics/Character Upper case, lower case and Greek. Black-on-white & White-on-black.

JADE PARALLEL/SERIAL INTERFACE KIT

KIT	$124.95
Assembled & Tested	$154.95

* S-100
* 2 Serial interfaces with RS232 interfaces or 1 Kansas City cassette interface.
* Serial interfaces are crystal controlled
* Selectable baud rates.
* Cassette works up to 1200 baud.
* 1 parallel port.

TV-1

Convert T.V set to Video Monitor

KIT... $8.95

JADE 8080A KIT

$100.00 KIT

BARE BOARD $30.00

JADE Computer Products

4901 W. Rosecrans -A
Hawthorne, Calif. 90250

CIRCLE INQUIRY NO. 85

AMERICAN EXPRESS Cards Welcome

Freight Charge $2.00 less than 10-lbs.

NEW CATALOG NOW AVAILABLE

"THE PIGGY IS COMING"

DIGI-KEY CORPORATION

Quality Electronic Components

TOLL FREE 1-800-346-5144

MINNESOTA RESIDENTS 218-681-6674

DON'T FORGET OUR DISCOUNTS WHEN COMPARING PRICES

I.C.'S • RESISTORS • TRANSISTORS • CAPACITORS • DIODES • I.C. SOCKETS & PINS • SWITCHES
CLOCK MODULES • OPTOELECTRONICS • BREADBOADING & TESTING DEVICES • DRAFTING SUPPLIES
DATA BOOKS • HEAT SINKS • WIRE • TOOLS . . . AND MORE . . . WRITE FOR FREE CATALOG . . . .

INTEGRATED CIRCUITS

TTL · 74LS00 · 74C00 · LINEAR · 4000 CMOS · INTERFACE · MISC IC

PREPAID SHIPPING AND INSURANCE

NEW! The "NIBBLER"

A MICROCOMPUTER AT A MICROPRICE!

The NIBBLER is Digi-Key's new low cost personal/hobby computer. Based on National Semiconductor's SC/MP-II microprocessor, the NIBBLER includes 4K NIBL Basic in ROM and 2K of RAM. The NIBBLER requires 5 volts at ½ amp providing 110 baud serial ASCII I/O which is easily interfaced with a CRT or Teletype. And our low price of $149.95 is for an assembled and tested system! Software/Hardware manual included with NIBBLER available separately for $5.00.

FEATURES:

- Assembled and Tested, yet only $149.95
- Standard 4.5" by 6.5" card with 72 pin edge connector pattern
- All IC's are socketed for easy maintenance
- Memory expandable to 28K
- 110 Baud Serial I/O
- It Speaks Basic Beautifully
- 4K NIBL Basic in ROM and 2K of RAM
- Easily Interfaced with CRT or Teletype

CATALOG NUMBER NIB1-ND $149.95
(not discountable)

SOFTWARE/HARDWARE MANUAL MAN1-ND $5.00
(not discountable)

Bishop Graphics 5"x6"

The Digi-Key Catalog features many more quality Bishop Graphics products. 3365-ND 12.50

WSU-30 Regular Wrap $6.95
WSU-30M Modified Wrap $7.95

STRIPS — WRAPS — UNWRAPS

PANAVISE

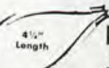
Call or Write for the Digi-Key Catalog for Panavise Details

DATA BOOKS

TTL DATA BOOK, 592 P, NAT. SEMI.	9010B	$4.00
LINEAR DATA BK, 952 P, NAT. SEMI.	9011B	$4.00
CMOS DATA BK, 77 EDIT, 555 P, NAT. SEMI	9012B	$3.00
POWER TRANSISTORS, 151 P, NAT. SEMI.	9014B	$3.00
MEMORY DATA BK, 592 P, NAT. SEMI.	9014B	$3.00
MOS/LSI DATA BK, 713 P, NAT. SEMI	9015B	$4.00
INTERFACE DATA BK, 464 P, NAT.	9016B	$4.00
VOLTAGE REG. BK, 128 P, NAT. SEMI	9017B	$3.00
LIN. APPLIC. BK, VOL. 1, 432 P, NAT. SEMI.	9018B	$4.00
LIN. APPLIC. BK, VOL. 2, 246 P, NAT. SEMI	9019B	$4.00
AUDIO HANDBOOK, 196 P, NAT. SEMI	9020B	$4.00
SC/MP MICRO. APP. HANDBK, NAT. SEMI	9022B	$5.00

SILICON TRANSISTORS

MPS918	.16	1.55/10	13.60/C	130.00/M
MPS930	.16	1.55/10	13.60/C	130.00/M
MPS2222A	.16	1.55/10	13.60/C	130.00/M
MPS2369A	.16	1.55/10	13.60/C	130.00/M
MPS2907A	.16	1.55/10	13.60/C	130.00/M
MPS3393	.16	1.55/10	13.60/C	130.00/M
MPS3393	.16	1.55/10	13.60/C	130.00/M
MPS3394	.16	1.55/10	13.60/C	130.00/M
MPS3395	.16	1.55/10	13.60/C	130.00/M



See Our Catalog For More Diamond Tool

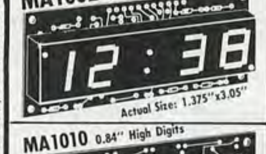
4½" Length

MS54 $6.89

ELECTROLYTIC CAPACITORS

VALUE · RADIAL LEADS · AXIAL LEADS

MA1002 0.5" High Digits



Actual Size: 1.375"x3.05"

MA1010 0.84" High Digits

Actual Size: 1.75"x3.75"

MA1003 $15.95 NEW!

CLOCK MODULES

Prices Slashed
Beyond All Recognition

MA1002A .5" LED 12 Hour AM-PM Clock Module	SOLD OUT		
MA1002A SET Module with Transformer & Switches	SOLD OUT		
MA1002C .5" LED 24 Hour Clock Module	~~$10.60~~	7.95
MA1002C SET Module w/Transformer & Switches	~~$10.95~~	9.95
MA1003 12 Volt Car Clock with Switches	~~$17.60~~	15.95
MA1010A .84" LED 12 Hour AM-PM Clock Module	~~$13.00~~	9.95
MA1010A SET Module w/Transformer & Switches	~~$16.45~~	11.95
MA1010C .84" LED 24 Hour Clock Module	~~$13.00~~	9.95
MA1010C SET Module w/Transformer & Switches	~~$16.45~~	11.95

The MA1002 and MA1010 series clock modules by National Semiconductor are fully assembled and tested clocks using a 4 digit LED display and an MOS integrated circuit on the same board. Simply connect switches and our special transformer and you have a fully functioning clock.

The MA1003 clock module is a fully assembled and tested 12 hour clock using a high brilliance green flourescent display and crystal time base making it perfect for car, boat or other portable use. It operates directly from 12 volts DC so no transformer is needed. Our price includes three push button switches for setting the time.

JMJ DIGITAL DISPLAY BEZEL

NEW

$4.95

PATENTED CHROMAFILTER SCREEN, DIE CAST METAL FRAME MOUNTS IN PANELS UP TO 3/16" THICK, NO EXPOSED HARDWARE, SCRATCH RESISTANT AND EASILY CLEANED, ELIMINATES GLARE.

MOUNTING ADAPTERS AVAILABLE TO SIMPLIFY MOUNTING AND ASSURE PERFECT ALIGNMENT.

400 BEZEL WITH RED FILTER	4.95
420 MOUNTING ADAPTER FOR MA1001 & MA1002	.69
421 MOUNTING ADAPTER FOR MA1010	[illegible]

NEW! POWERACE — SOLDERLESS BREADBOARDING WITH POWER FROM AP

POWERACE 103 923103 . . . . . $124.95
POWERACE 101 923101 . . . . . . $84.95
POWERACE 102 923102 . . . . . $114.95

POWERACE—for fast, solderless circuit building and testing. All models will accept all DIP sizes—plus TO-5's and discretes with leads to .032" diameter. POWERACE 101 has a variable 5-15 VDC 600 ma power supply. POWERACE 102 features a fixed 5VDC 1 amp power supply, and POWERACE 103 has a fixed 5VDC 750 ma power supply, A fixed plus 15VDC 250 ma power supply and a fixed -15VDC power supply at 250 ma.

5% CARBON FILM RESISTORS

¼ WATT RESISTOR ASSORTMENTS

Catalog Number	Description	PRICE
RS125	[illegible]	$9.90
RS225	[illegible]	$9.90

½ WATT RESISTOR ASSORTMENTS

Catalog Number	Description	PRICE
RS150	[illegible]	$9.90
RS250	[illegible]	$9.90

LED DIGITS AND LAMPS

LAMPS
NSL5053 Dif. Red T-1¾ Lamp w/Mtg. Hdwr. 1.80/10 16.00/100
NSL5056 Dif. Narrow Angle Red T-1¾ Lamp w/Mtg. Hdwr. 1.80/10 16.00/100

LED DISPLAYS
FND507 .5" Single Digit, CA, Red 1.35
FND800 .8" Single Digit, CC, Red 2.50
FND807 .8" Single Digit, CA, Red 2.50

DEVICE TYPE	DIGIT SIZE	FORMAT	DRIVE	PRICE
NSN334		+18	CA, DIRECT	$2.70
NSN373		88 No D.P.	CC, DIRECT	2.20
NSN374	0.3"	88 No D.P.	CA, DIRECT	2.20
NSN381	Red	88	CC, MULTI.	2.20
NSN382		88	CA, MULTI.	2.20
NSN534		+18	CA, DIRECT	2.60
NSN581		88	CC, MULTI.	2.60
NSN582	0.5"	88	CA, MULTI.	2.60
NSN583	Red	88	CC, DIRECT	2.60
NSN584		88	CA, DIRECT	2.60
NSN734		+18	CA, DIRECT	3.00
NSN781		88	CC, MULTI.	3.00
NSN782	0.7"	88	CA, MULTI.	3.00
NSN783	Red	88	CC, DIRECT	3.00
NSN784		88	CA, DIRECT	3.00
NSB3382		+888	CA, MULTI.	4.40
NSB3881	0.3"	8888	CC, MULTI.	4.40
NSB3882	Red	8888	CA, MULTI.	4.40
NSB5382		+888	CA, MULTI.	5.20
NSB5881	0.5"	8888	CC, MULTI.	5.20
NSB5882	Red	8888	CA, MULTI.	5.20
NSB7382		+888	CA, MULTI.	6.00
NSB7881	0.7"	8888	CC, MULTI.	6.00
NSB7882	Red	8888	CA, MULTI.	6.00

A·C·E 200·K
Part No. 923333
$18.95

Digi-Key Stocks the Entire AP Line

728 SOLDERLESS PLUG IN TIE POINTS CAPACITY: UP TO 8 16 PIN DIP's

SAMS BOOKS
(Not Discountable)

CMOS COOKBOOK	21398-ND	10.50
THE BIG CMOS WALL CHART	21399-ND	2.95
FET CIRCUITS (2ND EDITION)	21439-ND	4.95
IC TIMER COOKBOOK	21416-ND	9.95
PRINCIPLES AND APPLIC OF INVERTERS & CONVERTERS	21454-ND	7.95
ABC'S OF CAPACITORS (3RD EDITION)	21498-ND	4.95
ABC'S OF INTEGRATED CIRCUITS (2ND EDITION)	21462-ND	3.95
ABC'S OF RESISTANCE & RESISTORS	21126-ND	3.95
ABC'S OF VOLTAGE-DEPENDENT RESISTORS	20771-ND	3.25
ACTIVE-FILTER COOKBOOK	21168-ND	14.95
COLLECTED BASIC CIRCUITS	20784-ND	5.50
HOW TO DESIGN AND USE MULTIVIBRATORS	21043-ND	3.95
HOW TO USE INTEGRATED-CIRCUIT LOGIC ELEMENTS	21081-ND	4.95
IC OP-AMP COOKBOOK	20969-ND	12.95
LED CIRCUITS AND PROJECTS	21006-ND	5.25
MOS DIGITAL IC'S	21299-ND	6.50
PRACTICAL SOLID-STATE CIRCUIT DESIGN	21018-ND	6.50
RC CIRCUITS	21332-ND	4.95
REGULATED POWER SUPPLIES	20844-ND	5.50
RTL COOKBOOK	20715-ND	5.75
SOLID-STATE COMPONENTS	21099-ND	3.95
SOLID-STATE IGNITION SYSTEMS	21049-ND	4.95
SOLID-STATE POWER SUPPLIES & CONVERTERS	20310-ND	3.95
TRANSISTOR AUDIO AMPLIFIERS	20838-ND	5.95
TTL COOKBOOK	21035-ND	9.50
USER'S GUIDE TO TTL	21080-ND	2.50
TV TYPEWRITER COOKBOOK	21313-ND	9.95
UNDERSTANDING CMOS INTEGRATED CIRCUITS	21129-ND	4.95
UNDERSTANDING IC OPERATIONAL AMPLIFIERS (2ND EDIT)	21511-ND	4.95
UNDERSTANDING OSCILLATORS	20837-ND	4.95
UNIQUE IC OP-AMP APPLICATIONS	21163-ND	4.95
SEMICONDUCTOR DIODE LASERS	20887-ND	5.95
LASER FUNDAMENTALS AND APPLICATIONS	21130-ND	6.50
YOUR OWN COMPUTER	21483-ND	1.95
HOW TO BUY & USE MINICOMPUTER & MICROCOMPUTERS	21351-ND	9.95
HOW TO PROGRAM MICROCOMPUTERS	21459-ND	8.95

ADAM OSBORNE MICROPROCESSOR BOOKS
(Not Discountable)

HAYDEN BOOKS
(Not Discountable)

I.C. SOCKETS

SOLDERTAIL SOCKETS ARE LOW PROFILE · WIRE WRAP SOCKET ARE STANDARD PROFILE

Part No.	Description			
40-ST	40 Pin Solder Tab I.C. Socket	.63	6.00/10	53.50/C
8-WW	8 Pin Wire Wrap I.C. Socket	.24	2.30/10	20.50/C
14-WW	14 Pin Wire Wrap I.C. Socket	.26	2.50/10	22.00/C
16-WW	16 Pin Wire Wrap I.C. Socket	.30	2.85/10	25.50/C
18-WW	18 Pin Wire Wrap I.C. Socket	.60	5.70/10	51.00/C
20-WW	20 Pin Wire Wrap I.C. Socket	.70	6.65/10	59.50/C
22-WW	22 Pin Wire Wrap I.C. Socket	.84	8.00/10	71.50/C
24-WW	24 Pin Wire Wrap I.C. Socket	.96	9.10/10	81.50/C
28-WW	28 Pin Wire Wrap I.C. Socket	1.12	10.00/10	95.20/C
40-WW	40 Pin Wire Wrap I.C. Socket	1.36	12.50/10	115.00/C

MOLEX I.C. SOCKET PINS

.85/C 8.20/M 38.20/5M 275.00/50M

MICROPROCESSORS

8080A	8-BIT CPU, 2 USEC CYCLE	$ 9.95
8212	8-BIT I/O PORT	$ 3.25
8216	BI-DIRECTIONAL BUS DRIVER	$ 3.25
8224	CLOCK GENERATOR	$ 3.25
8228	SYSTEM CONTROLLER	$ 6.00
8251	COMMUNICATIONS INTERFACE	$10.50
8255	PERIPHERAL INTERFACE	$10.50
1702A	2K EPROM 1 USEC	$ 5.75
2708	8K EPROM 450 NSEC	$15.75
2102AN-4L	1K LOW POWER 450 NSEC RAM	$ 1.69
SC/MP	5 VOLT SC/MP CPU	$ 9.95
2650	MICROPROCESSOR 1.25 MH-2 CLOCK 40 DIL	$24.95

½ WATT ZENER DIODES

.15 1.30/10 11.00/C

1N5226B	3.3V	1N5242B	12V
1N5227B	3.6V	1N5243B	13V
1N5228B	3.9V	1N5244B	14V
1N5229B	4.3V	1N5245B	15V
1N5230B	4.7V	1N5246B	16V
1N5231B	5.1V	1N5247B	17V
1N5232B	5.6V	1N5248B	18V
1N5233B	6.0V	1N5249B	19V
1N5234B	6.2V	1N5250B	20V
1N5235B	6.8V	1N5251B	22V
1N5236B	7.5V	1N5252B	24V
1N5237B	8.2V	1N5253B	25V
1N5238B	8.7V	1N5254B	27V
1N5239B	9.1V	1N5255B	28V
1N5240B	10V	1N5256B	30V
1N5241B	11V	1N5257B	33V

SILICON DIODES

1N4001	.64/10	5.50/C
1N4002	.66/10	5.60/C
1N4003	.68/10	5.80/C
1N4004	.70/10	5.95/C
1N4005	.82/10	7.05/C
1N4006	.90/10	7.75/C
1N4007	.99/10	8.60/C
1N4148	.40/10	3.50/C

SLIDE SWITCHES

SPST	.15	1.25/10	10.00/C
SPDT	.19	1.70/10	13.00/C
DPDT	.23	2.00/10	19.00/C

Call or Write For **FREE CATALOG**

• DIGI-KEY MEANS QUALITY PRODUCTS

MINIBOX METALIZED POLYESTER CAPACITORS

8080A CHIP SET

ONE EACH 8080A, 8212, 8224 and 8228 PLUS SIXTEEN 2102AN-4L ALL FOR — **$44.95**

HARDWARE

2-56 1/4 SCREW	.99/C
2-56 1/2 SCREW	.99/C
4-40 1/4 SCREW	.65/C
4-40 1/2 SCREW	.60/C
6-32 1/4 SCREW	.65/C
6-32 1/2 SCREW	.75/C
8-32 3/8 SCREW	.90/C
8-32 5/8 SCREW	.99/C
2-56 HEX NUT	.55/C
4-40 HEX NUT	.55/C
6-32 HEX NUT	.60/C
8-32 HEX NUT	.60/C
NO. 2 LOCKWASHER	.85/C
NO. 4 LOCKWASHER	.45/C
NO. 6 LOCKWASHER	.45/C
NO. 8 LOCKWASHER	.45/C

DOUBLE DIGIT DISCOUNTS SAVE YOU EVEN MORE!

HANDLING CHARGES

$ 0.00-$ 4.99 . . . Add $2.00
$ 5.00-$24.99 . . . Add $0.75
$ 25.00-$49.99 . . . Add $0.50
$ 50.00-$99.99 . . . Add $0.25
$100.00 & Up . . . No Charge

VOLUME DISCOUNT & HANDLING CHARGE

All items except those with catalog numbers ending with the suffix-ND may be combined for discount. First—total all discountable items and apply the volume discount. Then add to this subtotal the nondiscountable items. Add the handling charge. This is your total cost. We pay all shipping and insurance to addresses in the U.S.A. and Canada.

VOLUME DISCOUNT

$ 0.00-$ 24.99 . . . . . NET
$ 25.00-$ 99.99 . Less 10%
$ 100.00-$499.99 . Less 15%
$ 500.00-$999.99 . Less 20%
$1000.00 & Up . . . Less 25%

Orders Accepted by Phone or Mail
MasterCharge • Bank-Americard • COD • Check • Money Order
P.O. Box 677, Thief River Falls, Minn. 56701 (218) 681-6674

DIGI-KEY CORPORATION

Quality Electronic Components

P.O. Box 677 Thief River Falls, MN 56701 (218) 681-6674

Bishop COOLGLO Light Table

110 Vac 18"x20" Portable Light Table
Cat. No. 3200-ND . . . $139.50
(Not Discountable)

50 VOLT DISCS

100 PF	.40/10	3.50/C
220 PF	.40/10	3.50/C
470 PF	.40/10	3.50/C
.001 UF	.40/10	3.50/C
.0022 UF	.40/10	3.50/C
.0047 UF	.40/10	3.50/C
.01 UF	.45/10	3.65/C
.022 UF	.50/10	4.00/C
.047 UF	.70/10	5.60/C
.1 UF	1.35/10	11.50/C

STRANDED HOOK UP WIRE

20 ga PVC 2.50/100' 10.00/500'
22 ga PVC 2.80/100' 11.25/500'
24 ga PVC 2.80/100' 11.25/500'

 CIRCLE INQUIRY NO. 84

"Turnkey" Video Interface Boards

The CRT-1000 is the first in a new line of video interfaces available from Nucleonic Products Company.

Available in both 50 Hz (CRT-1000A) and 60 Hz (CRT-1000B), these are the most compact and reliable video interfaces available.

Based on NPC's unique CRT Processor Chip — the SFF96364, the CRT-1000 packs a lot of function into 3.5" x 5".

Price is $119.95 (single-stock). For more information contact Mike Levin at Nucleonic Products Company, (213) 887-1010.

CIRCLE INQUIRY NO. 118

Hermeticity and Acceleration Testing

Solid State Testing has expanded their evaluatory service to encompass hermeticity (fine and gross leak) testing and acceleration testing of IC's, diodes, and transistors, regardless of package style. With this expansion the firm now offers full testing to MIL-M-38510, MIL-STD-883, MIL-STD-750, and MIL-S-19500 specifications.

Fully equipped with Trio-Tech test systems, shipments are typically processed within 48 hours. Solid State Testing will provide quotations upon receipt of customer requirements. For more information contact Solid State Testing, Inc., 56 Middlesec Turnpike, Burlington, MA 01803, (617) 272-0972, James DiGiacomo, Vice-President Marketing.

CIRCLE INQUIRY NO. 194

30 MHz Function Generator

The Model 737 introduces many features not available on standard function generators. It produces clean crisp triangles, sine waves, square waves and pulses over a frequency range of 0.0001 Hz to 30 MHz using twelve ranges.

A trigger mode allows lockout of waveform until application of a gate or trigger signal. If the trigger mode selected is pulse, a single cycle of the waveform will be produced for each signal applied from the trigger source. If the trigger mode selected is burst, the waveform will be continuously produced as long as the signal from the trigger source is applied.

Three input signals may be selected as the trigger source, 1) a manual pushbutton on the front panel, 2) an external signal via a rear panel BNC jack, or 3) an internal signal from a second generator in the Model 737, the Ramp/Step Generator.

The Model 737 is priced at $1,295. FOB Hillsboro, OR and delivery is 4 weeks ARO. For more information contact Joe Foster, Exact Electronics Inc., 455 S.E. 2nd Ave., Hillsboro, OR 97123, (503) 648-6661.

CIRCLE INQUIRY NO. 167

CIRCLE INQUIRY NO. 82

CIRCLE INQUIRY NO. 73

CCI

VACATION BOOK SALE

Basic Software Library—Vol. I & II	$24.95
Basic Software Library—Vol. III & VII	$39.95
Basic Software Library—Vol. IV & V	$ 9.95
Basic Software Library—Vol. VI	$49.95
Basic Software Library—Vol. VIII	$19.95
Creative Computing—Vol. I & II	$ 8.95
Instant Basic	$ 7.50
101 Basic Games	$ 7.50
8080 Bug Book	$ 9.95
Sam Z-80 Program	$ 8.50
Cheap Video Cook Book	$ 5.95
Basic Basic	$ 8.95
Advanced Basic	$ 6.95
I.C. Timer	$ 9.95
TTL Cook Book	$ 9.50
Your Own Computer	$ 1.95
Z-80 Assembly Language	$ 7.50
Z-80 ZPU Technical Manual	$ 7.50
Z-80 Program Logic Design	$ 7.50
First Book of Kim	$ 8.95
SYBEX Microprocessor	$ 9.95
SYBEX Micro Interfacing Techniques	$ 9.95
How to Build a Computer Controlled Robot	$ 7.95
OSBORNE	
Intro to Micro—Vol. 0 & I	$ 7.50
Intro to Micro—Vol. II	$15.00
8080 Programming	$ 7.50
6800 Programming	$ 7.50
Z-80 Programming	$ 7.50
Some Common Basic Programs	$ 7.50
Payroll with Cost Accounting	$12.50
C-MOS Cook Book	$10.50
How to Program Micro Computer	$ 8.50
BUG BOOKS	
Bug Book Vol. I & II & IV & VII	$ 8.50
Bug Book Vol. III	$15.00
Bug Book Vol. V & VI	$ 9.50
The 555 Timer Applications	$ 6.95
The Design of Active Filters	$ 8.50

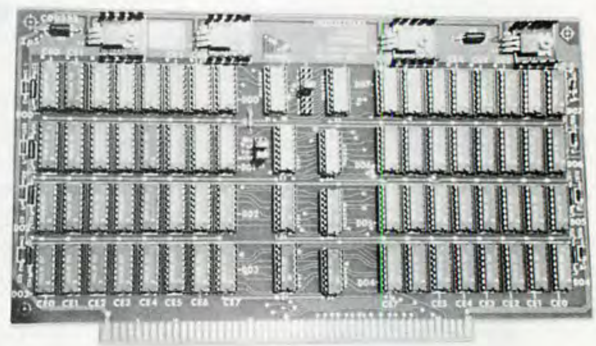
....

WE STOCK A COMPLETE LINE OF BOOKS

ALL BOOKS 10% OFF
TAB BOOKS 20% OFF

PRICES IN EFFECT THRU OCT. 30

IMS MEMORY MADNESS



INDUSTRIAL MICRO SYSTEMS

8K STATIC

GUARANTEED TO RUN AT 4 Mhz

$159.95

"WORLDS FINEST 8K MEMORY MODULE"

....

ALSO

16K	250ns	REG. $555	**NOW $469**
16K	450ns	REG. $525	**NOW $429**

....

WE ARE A FULL LINE IMS DISTRIBUTOR

....

BANK OF AMERICA AND MASTERCHARGE WELCOME. TERMS: MIN. ORDER $10.00 ADD $2.00 POSTAGE AND HANDLING IF ORDER IS UNDER $25.00 AND SENT U.P.S. ADD $4.00 POSTAGE AND HANDLING IF SENT VIA U.S. MAIL.

COMPUTER COMPONENTS INC.

5848 Sepulveda Blvd., Van Nuys, CA 91411
(213) 786-7411
4705 Artesia Blvd., Lawndale, CA 90260
(213) 370-4842
6791 Westminister Ave., Westminister, CA 92683
(714) 898-8330
3808 Verdugo Ave., Burbank, CA 91505
(Watch for grand opening)
CLOSED SUNDAYS AND MONDAYS

CCI

CIRCLE INQUIRY NO. 76

BOOK REVIEWS

MICROPROCESSOR INTERFACING TECHNIQUES SECOND EDITION

By Austin Lesea & Rodnay Zaks
Sybex, Berkeley, California.

Review by Roger H. Edelson, Hardware Editor

This book packs a tremendous amount of information in its 400 some pages. It will teach you how to interconnect a complete microprocessor system and interface it to all the usual peripherals. Both the hardware and software skills needed to effectively interface peripheral devices are covered along with various bus standards and analog/digital conversion.

The book begins with a chapter introducing the techniques to be discussed, bus details, followed by a section on the Central Processing Unit (CPU). Chapter 3 presents the set of input/output techniques which will be used to communicate with the external world, including a brief survey of the existing chips which are useful in the implementation of these techniques.

The major theme of the book is found in Chapter 4. It is here that the microprocessor is interfaced with all the major peripheral devices. Keyboards, LED displays, teletypes, CRT displays, floppy disks and more are all covered. In addition, this chapter describes various tape recorder interfaces, including Tarbell and Kansas City standards. Interestingly, in the CRT interface section the first available CRT interface chip which was manufactured by SMC Microsystems Corporation, the CRT 5025, is not mentioned.

The next chapter (Chapter 5) covers various digital-to-analog and analog-to-digital conversion methods, interfacing, real products, and subjects such as scaling and offset. The following chapter provides an overview of some of the more general bus standards: S-100, 6800, IEEE-488, EIA-RS232C and RS422. The final two sections deal respectively with the design of a 32-channel multiplexer (used as a case study) and informative material on digital trouble-shooting.

The material provided in the appendices is more usable than most, with one of the more complete presentations of S-100 bus manufacturers that I have ever seen. Unfortunately, these compendiums are out of date almost as soon as the book is published.

The writing is clear and emminently readable with an informative style which never becomes pedantic. This book is not intended for the novice in the field of microprocessors as it assumes a basic understanding of these devices and systems. You may either read this book as a text devoted to the principles and practice of microprocessor interfacing, or use it to provide detailed information to solve a particular design problem. Either way, it will serve the desired purpose admirably.☐

INTRODUCTION

to the

TEX AND INDEXING VECTORS

A great strength of TEX is the ability to handle data not of fixed length. Yet it must be used often as elements of vectors. Some examples appeared in the program "today", shown in Part I. Here are others, starting with the program "morse" of Figure 1.

```
!morse call !init                                           a

!start line=*null in:"CHAR(S)?  " split:*in:0               b
if *lin:eq:0 nosubs nocase return                           c

!loop split:*r:1 s=set>*l lg=line>*null                     d
if lg:le:232 line=line,"  ",m$s$                            e
if *lr:ne:0 goto !loop                                      f
if lg:gt:232 out:"Output truncated."                        g

!display split:line:72                                      h
if *lr:eq:0 out:line out:" " goto !start                    i
lineone=*l line=*r split:line:1                             j
if *l:eqs:" " out:lineone line=*r>'^" " goto !display       k
scanr:lineone:"  " out:*l line=*r,line goto !display        l

!init clear * case subs $                                   m
set=\etaoinshrdlubcfgjkmpqvwxyz,.-?;:0123456789'"()_/\      n
m0="." m1="-" m2=".-" m3="---" m4=".." m5="-."              o
m6="..." m7="...." m8=".-." m9="-.." m10=".-.."
m11="..-" m12="-..." m13="-.-." m14="..-." m15="--."
m16=".---" m17="-.-" m18="--" m19=".--." m20="--.-"
m21="...-" m22=".--" m23="-..-" m24="-.--" m25="--.."
m26="--..--" m27=".-.-.-" m28="-....-" m29="..--.."
m30="-.-.-." m31="---..." m32="------" m33=".----"
m34="..---" m35="...--" m36="....-" m37="....."
m38="-...." m39="--..." m40="---.." m41="----."
m42=".----." m43="-..-." m44="-.--.-" m45="-.--.-"
m46="..--.-" m47="-..-.." m48=" " return                   p
```

Figure 1. A TEX program called "morse"

Comments on the program "morse" are keyed by the letters on the right:

a The section "init" is called to set up the variables.
m With "case" mode in force, lower case and capital letters will be interpreted as the same. The substitution mode is set for the character "$".
n The set of characters to be translated is put into the variable "set", in pseudo frequency order, to minimize search time.
o Variables "m" (sub "s") are assigned the Morse code equivalents. The letter "e" has position zero in the variable "set", so "m0" is assigned its code — a single dot. Position 48 is one beyond the last in "set", so spaces and unassigned characters will be represented by no code, being "m48".

We might have used a more direct translation method by using the names "me", "mt", "ma", etc., except that only alphabet, digits, and the underscore are permissible in variable names and labels. "m," would not be permissible, and we must translate the comma too. All names here are begun with "m", as variable names must begin with a letter.

b The output line is created as a null string. An input string is requested. Splitting it 0 places from the left puts the whole input string in *r, preparing it for the loop in line "d".
c On a null response (a return only), the modes are turned off, and control returns to the caller.
d The leftmost character is now in *l. The value of "s" is determined by scanning "set" for that character. The length of the current output line is determined by scanning for the null character.
e TEX variables are limited to 240 characters. If the line is not already greater than 232, it is OK to add one space and the maximum of six dots and/or dashes.
f If characters of the input remain, return to "!loop".
g Otherwise stop there if the limit is reached, and fall through to "!display".
h The first 72 characters of the output line are taken.
i If no others remain, the line is displayed and the process is repeated by going to "!start".
j "lineone" takes the first 72 characters, "line" the rest. *l gets the initial character of "line".
k If it is a space, the last Morse character in lineone is complete. We display it, kill the leading blanks in "line", and repeat the display process.
l Otherwise "lineone" is scanned from the right for the first space. *l is complete for display, and the residual is shifted to the beginning of "line".

We usually record DWECO time (Develop, Write, Enter, Check Out) for TEX programs. This Morse program took an even three hours. When it ran, I guessed that it might take an hour to modify it to a Braille program. It actually took 38 minutes, including looking up Braille symbols in the dictionary!

Figure 2 is a later version of that original Braille program. Another 3 hours are invested, because there is now an option to read directly (for the sighted) or emboss (in reverse — the unsighted read the indentations on the *back* of the paper). Plus a self-test option not shown here.

It has also been modified to use single symbols for the digits and other punctuation. This permits direct comparison with a Fortran program for Braille that was

Part Two

TEX Language

By Robert W. Bemer

shown on page 25 of the 1978 April issue of Datamation magazine.

```
!braille call !init                                              a

!start out:" " in:"CHAR(S)?  " split:*in:0                       b
if *lin:eq:0 nocase nosubs clear * return                        c

!loop if count:eq:24 call !reset                                 d
split:*r:1 s=set>*l count=count+1                                e
|see_it| t=t," ",t|s| m=m," ",m|s| b=b," ",b|s|                  f
|emboss| t=t|s|," ",t m=m|s|," ",m b=b|s|," ",b                  g
if *lr:ne:0 goto !loop                                           h
call !reset'goto !start                                          i

!reset out:t t=*null out:m m=*null out:b b=*null                 j
out:" " out:" " count=0 return                                   k

!init in:"Want the embossing mode?  " case q=*in']1              l
see_it=\if q:nes:"y"\ emboss=\if q:eqs:"y"\ subs |               m
count=0 a="  " b=" ." c=". " d=".."                              n
|emboss| b=". " c=" ."                                           o
set=\etaoinshrdlubcfgjkmpqvwxyz,.-+=*0123456789%"()&/$\          p
t0=c t1=b t2=c t3=c t4=b t5=d t6=b t7=c t8=c t9=d                q
t10=c t11=c t12=c t13=d t14=d t15=d t16=b t17=c t18=d
t19=d t20=d t21=c t22=b t23=d t24=d t25=c t26=a t27=a
t28=a t29=b t30=b t31=c t32=a t33=a t34=a t35=a t36=a
t37=a t38=a t39=a t40=a t41=a t42=d t43=c t44=c t45=b
t46=d t47=b t48=b t49=a
m0=b m1=d m2=a m3=b m4=c m5=b m6=c m7=d m8=d m9=b
m10=c m11=a m12=c m13=a m14=c m15=d m16=d m17=a m18=a
m19=c m20=d m21=c m22=d m23=a m24=b m25=b m26=a m27=b
m28=a m29=a m30=c m31=a m32=b m33=c m34=c m35=d m36=d
m37=c m38=d m39=d m40=c m41=b m42=d m43=c m44=d m45=d
m46=c m47=a m48=b m49=a
b0=a b1=c b2=a b3=c b4=a b5=c b6=c b7=a b8=c b9=a
b10=c b11=d b12=a b13=a b14=a b15=a b16=a b17=c b18=c
b19=c b20=c b21=d b22=b b23=d b24=d b25=d b26=b b27=b
b28=d b29=d b30=b b31=b b32=d b33=a b34=c b35=a b36=b
b37=b b38=c b39=d b40=d b41=c b42=b b43=b b44=d b45=d
b46=d b47=c b48=d b49=a t=*null m=*null b=*null return           r
```

Figure 2. A TEX program called "braille"

Comments on the program "braille" are:

- l Initialization is started by selecting the embossing mode, or not. "q" is the first letter of the reply, and case-independent.
- m "see_it" is assigned to mean "if reply wasn't yes". "emboss" is assigned to mean "if reply was yes".
- n "count" is set to zero for the output line length. Variables "a" through "d" are assigned as the four possible conditions in the top, middle, and bottom rows of the Braille symbols.
- o But if the embossing mode is selected the symbols must be inverted, which affects "b" and "c" only.
- p Again the set of allowable input characters.
- q Through line r, the three components of each symbol are assigned. The output lines "t", "m", and "b" are created null,and the program returns to "!start".
- d When count reaches 24, 72 columns are used up, and it is time to output the line so far by calling "!reset" (j and k), which outputs the three lines and resets them to null, adding two spacing lines.
- e The input character position is found in "set".
- f For the condition "see-it", the new symbol "t|s|, m|s|, b|s|" is added on the right.
- g For the condition "emboss", it is added on the left.
- h If there is more to the input string, continue at "!loop".
- i Otherwise output the last short line and return to "!start" for a possible new input string.

```
!roman clear * subs |                                            a
split="splitr:*l:1 if *lr:ne:0 d=*r*5 output="                   b
em="MMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMM" em=em,em,em,em             c
u_str="    I    II   III    IV     V    VI   VII VIII    IX"     d
t_str="    X    XX   XXX    XL     L    LX   LXX LXXX    XC"     e
h_str="    C    CC   CCC    CD     D    DC   DCC DCCC    CM"     f

!again in:"Your number, in digit form?  "                        g
if *lin:eq:0 nosubs return                                       h
splitr:*in:0                                                     i
|split|(u_str']d)<'" "                                           j
|split|(t_str']d)<'" ",output                                    k
|split|(h_str']d)<'" ",output                                    l
if *ll:ne:0 output=em['*l,output                                 m
out:output goto !again                                           n
```

Figure 3. A TEX program for Roman Numerals

Figure 3 presents a few new usages:

- b Having set the substitution mode, "split" is defined to contain an incomplete piece of procedure (under the 240-character limit, being the content of a variable). This is done for both storage economy and understanding in lines j, k, and l.
- c The Romans didn't provide well for large numbers. A long string of "M"s must be created for truncation.
- d The units position equivalents are a string vector.
- e An equivalent pattern for the tens position.
- f And for the hundreds position.
- g After creation of constants, a number is requested.
- h On a null reply, control is returned to the caller.
- i The old trick, to get the input into *left.
- j The content of "split" is substituted prior to execution. It picks up the rightmost position, and if that is

not null (meaning the process is complete) it is multiplied by 5, and "output" is set to the value obtained by truncating the units string that many positions, scanning left until a space is found, and keeping the righthand part. Thus the Roman equivalent of the units digit is obtained.

k The process is repeated for the tens position, and the units position data appended.

l The same for the hundreds position.

m If the length of the lefthand remainder is not zero, the number is 1000 or more, and a suitable number of "M"s is extracted.

n The output is displayed, and one may try again.

Here are two final vector examples, from a program that converts spelled-out numerals to digit form. By this time you should be able to figure out their operation by yourself, and I might as well give you lots of generally good tricks to have in your string bag.

In this example, "xx" is a numeral, in words, from 1 to 99. It is also the output, in digits:

```
trans="##ontwthfofisiseeiniteel" case
scan:xx:"ty" if *lm:ne:0 call !over19 return
scan:xx:"teen" arg=*l']2
if *lm:ne:0 call !translate xx="1",digit return
if xx:eqs:"twelve" xx=12 return
call !translate xx=digit return

!over19 arg=*l']2 call !translate xx=digit
if *r:eqs:*null xx=xx,"0" return
arg=(*r<'^*a)']2 call !translate xx=xx,digit return

!translate digit=(trans>arg)/2 if s:gt:22 digit="(???)"
return
```

In this example, "xx" is a power of 10 (and digit output):

```
z="00000000000" zero=z,z,z
big="######milbiltriquaquisexsepoctnondec"
if xx:eqs:"hundred" xx="00" return
if xx:eqs:"thousand" xx="000" return
if xx['6:eqs:"illion" s=big>(xx']3) xx=zero']s return
```

STAR FUNCTIONS/VARIABLES

Star functions are implicit (not explicit) variables. They cannot be assigned arbitrary values, but are "read-only". (Effectively, the "active functions" of C. Mooers).

The ones most frequently used are those derived from using the verbs "scan" and "split", which generally break a string into 3 parts, of which the middle part may be null.

Part		Length of Part	
Full Name	Abbrev.	Full Name	Abbrev.
*left	*l	*lleft	*ll
*middle	*m	*lmiddle	*lm
*right	*r	*lright	*lr

The forms are:

```
scan:A-operand:B-operand        (becomes *m)
scanr:A-operand:B-operand       (becomes *m)
split:A-operand:B-operand       (becomes *ll)
splitr:A-operand:B-operand      (becomes *lr)
```

For the scan verb, B-operand is the string to find within A-operand. "scan" seeks the first occurrence searching from the left; "scanr" seeks the first occurrence searching from the right. It is identical to the resulting "*middle".

For the split verb, B-operand is the number of characters to the point where A-operand should be split into two parts. For "split" the count is from the left; for "splitr" it is from the right. It is identical to the resulting "*ll" or "*lr" respectively. *middle is null, with zero length.

Both A- and B-operands may be the content of variables (including star functions) or explicit strings. Examples:

```
scan:variable:"Bob"
scanr:"ab..yz":substring
split:variable:6
splitr:variable:(3*apples+oranges)
```

There are at least two ways to get the length of a variable:

```
scan:variablename:*null        (length = *ll)
split:variablename:0           (length = *lr)
```

"scan" and "scanr" also have variants "scann" and "scannr" respectively, which seek non-occurrence of the B-operand, rather than occurrence. It isn't practical to scan for non-occurrence except for a single character, so in these two cases (scann and scannr) the B-operand is so limited.

In all cases the B-operand may also be specified as a character of a class. TEX now has five star functions that are specifiers for generic classes of characters:

*lc	lower case	the 26 small ASCII letters
*uc	upper case	the 26 capital ASCII letters
*n	numeric	the 10 digits 0-9
*a	alphabetic	*lc (plus) *uc
*an	alphanumeric	*a (plus) *n

Scan always forms *left and *right, but not always *middle, due to conditions of not-character, or character-of-a-class. Figure 4 gives the rules. If *m is null, *r begins with the first character found to meet the scan condition.

On the A-operand	<--------B-operand--------> String-length Any	One	Class Specifier	Corresponding Operator
scan	string	string	null	>
scanr	string	string	null	<
scann		null	null	>^
scannr		null	null	<^

Figure 4. *middle and the Scan Verb

Scan and split verbs have counterparts in operators (<>[]). But the operators do not affect functions *l, *m, *r, etc., and only one result is obtained. Figure 5 shows the scan operator rules. For explanation:

- •Right portion begins with string/class found/not-found
- •Left portion is A-operand less the right portion
- •Length is the length of the left portion

Scan from Left	Scan from Right	<-------B-operand-------> String-length Any	One	Class Specifier	Result saved Number	Result saved A-operand
>		x	x	x	length	
>^			x	x	"	
	<	x	x	x	"	
	<^		x	x	"	
'>		x	x	x		L portion
>'		x	x	x		R portion
'>^			x	x		L portion
>'^			x	x		R portion
	'<	x	x	x		L portion
	<'	x	x	x		R portion
	'<^		x	x		L portion
	<'^		x	x		R portion

Figure 5. Permissible Scan Operators and Results

Figure 5. Permissible Scan Operators and Results

Figure 6 shows the rules for the split operators:

Split from Left	Split from Right	Result Saved
']		L portion
]'		R portion
	'[	L portion
	['	R portion

Figure 6. Results of Split Operators

All star functions are operable in either upper or lower case. Some others that are available for use are:

*account contains the "userid" subaccount number, if any.
*cl contains the current line of the current file. If there is no current file, or if TEX is at end of file, *cl is null.
*clvl contains a number equal to the current depth (level) of "calls".
*date contains today's date in the form "yy-mm-dd". If necessary, fields of *date are zero-filled so that it always has 8 characters.
*eof contains "f" if there is a current file and TEX is not at end of file. *eof contains "t" if there is no current file, or if TEX is at end of file.
*in contains the last response to an "in" or "int" command. The carriage return at the end of a line entered at a terminal is not included. If a null response was obtained from a file, or if a single carriage return was obtained from a terminal, *in will be null. *in is initially null.
*lcl is the length of *cl.
*lin is the length of *in.
*null contains the null string, of zero length.
*random contains a randomly-selected digit whenever *random is referenced.
*rmdr has the remainder of the last division operation.
*snumb contains the identifying number of the last batch job spawned in the current timesharing session. If no job has been spawned, *snumb will be null.
*time contains local 24-hour time in the form hh:mm:ss. Like *date, *time always has 8 characters.
*userid contains the userid under which TEX is being used.

This trivial program, to find the number of characters in a file, shows the use of *lcl.

```
count=0
!loop if ^*eof count=count+*lcl f;1 goto !loop
out:"File contains ",count," characters." return
```

Star functions also exist for the 32 control characters in the first two columns of ASCII and the "delete" character (shown here in the capital option):

```
*NUL Null                     *DLE Data Link Escape
*SOH Start of Heading         *DC1 Device Control 1
*STX Start of Text            *DC2 Device Control 2
*ETX End of Text              *DC3 Device Control 3
*EOT End of Transmission      *DC4 Device Control 4 (Stop)
*ENQ Enquiry                  *NAK Negative Acknowledge
*ACK Acknowledge              *SYN Synchronous Idle
*BEL Bell                     *ETB End of Transmission Block
*BS  Backspace                *CAN Cancel
*HT  Horizontal Tab           *EM  End of Medium
*LF  Line Feed                *SUB Substitute
*VT  Vertical Tab             *ESC Escape
*FF  Form Feed                *FS  Field Separator
*CR  Carriage Return          *GS  Group Separator
*SO  Shift Out                *RS  Record Separator
*SI  Shift In                 *US  Unit Separator
*DEL Delete
```

These will be found useful for terminals or other devices that are not full ASCII. They can also be used directly in "out" commands. The following draws a small box, sounding the bell at start and finish:

```
out:*bel,"____",*cr,*lf,"|  |",*cr,*lf,"|__|",*bel
```

TEX EXECUTIVE FILES

The previous example illustrates an important aspect of TEX. If commands are entered directly at the terminal, they will be executed after the Return Key is pressed. If the same command is made a part of a file, it will not be executed until that file is called. It may be called as the current file ("call *") or as a saved file ("call filename").

Such files are called "executive files". An implicit response from the terminal, such as an extra "return", is simulated by a single entry line of "*null".

The columns mode localizes the operational mode of editing actions to between two defined column positions.

One valuable byproduct of this separation is that if one is hesitant, while programming and entering a program, about the legality or effect of some command, it is a simple matter to terminate the build mode and actually execute the command to test its effect. When the question is resolved satisfactorily, file building may be resumed.

SUMMARY OF MODES

Modes are set and turned off globally. The paired commands are:

```
subs     nosubs          trace   notrace
case     nocase          cols    nocols
verify   noverify        octl    noctl
```

Instances of the first two modes have been shown copiously in the examples so far.

The verify mode (also controlled by abbreviations "veri" and "nove") simply shows at the terminal the result of each action taken, or command executed.

The trace mode (also controlled by abbreviations "trac" and "notr") has no effect upon commands received from a terminal. But if they are received by a called executive file, the verify mode will be simulated. Inserting trace and notrace pairs in the executive file is an effective diagnostic method.

The columns mode localizes the operational mode of editing actions, to between two defined column positions.

The octal mode permits reference to all 512 different 9-bit characters, by defining their names as the octal values prefixed by an assigned character.

ORDER OF OPERATOR PRECEDENCE

Expressions are evaluated left to right wherever operators are of equal precedence. Otherwise evaluation takes place in this order:

1. Any expression within parentheses is evaluated before elements outside the parentheses (the maximum number of real and implied parenthesis pairs for the HIS TEX processor is 16).
2. Unary operators (+, −, or ^).
3. Scan/split operators (>, <,], or [).
4. Multiplicaton/division (* or /).
5. Addition/subtraction (+ or −).
6. Concatenation (,).
7. Comparison. □

Child's Play Number Game for Beginning Micro-Bugs

By Karen S. Wolfe

Anyone with the remotest knowledge of computers realizes their great educational possibilities. But you seldom see an elementary program for just that purpose — to educate the young. So here's a quick program that serves two purposes: to provide a mathematical game for youngsters just learning about numbers, and to provide a short, easy program with which beginning programmers can experiment.

WHAT DOES IT DO?

The program initially asks the child to enter a number between 1 and 10. Of course, most children won't be able to read the question right away. You must guide their way through the game the first few times. You'll probably be surprised how quickly the child catches on to the questions and the feedback. So another purpose is served: teaching the child the necessity of learning to read.

Now numbers other than those between 1 and 10 can be entered, but it is best to start with small numbers. Suppose the child enters a 4. The program will then display four stars (*) on the monitor, followed by the numeral "4". Then, on the first pass through the program, one star followed by a "1" will appear below the four stars. This provides the child with a visual display of a set of "4" objects and a set of "1" object.

Next, the program asks the child to enter the answer for

4 + 1 = ? in algebraic form and also

$$\begin{array}{l} 4 \\ \underline{1} \\ ? \end{array}$$ in column addition form.

The visual set of stars is still on the screen, so the child will initially count all the stars to arrive at an answer. As the child begins to associate numerals with the concept of so many objects, you can rewrite the program so that the stars are no longer printed (see the section on experimentation following).

When the child enters an answer, the program checks to see it is the right answer. If it is right a series of stars is printed and the message "YOU ARE CORRECT — YOU WIN!!!". If the answer is wrong, the feedback is "SORRY, THE ANSWER IS NOT CORRECT, TRY AGAIN!" Even if the child cannot yet read, he or she soon learns these responses and their meanings with just a little help from you.

When the child's answer is wrong, the problem is repeated. When the answer is correct, the program automatically forms a new problem if the child wishes to play another game. The program continues to use the 4 which was originally input, but on the second pass through it asks the child to add a "2" to the 4. On the third pass it adds a "3" and so on through six passes. At that point, the program will ask the child if he or she wants a different input number and if he wants to play another game.

EXPERIMENTATION

The accompanying program is short and uses a number of "FOR-TO" loops, "IF-THEN'S" and "GOTO'S" to accomplish its objectives. The beginning programmer should be able to follow the steps with just a little study and then be ready for some experimentation of their own.

First of all, this program was written for North Star BASIC in which multiple line statements are separated by "\". In this program, they are used only to separate PRINT statements which are used for spacing the screen displays.

The C variable is the number entered by the child. The K variable is the internal number which is added to C. When the program is first started, K is set at zero (line 20). In line 60, K is increased by 1. In each successive pass through, the program is cycled back to line 60. When K finally equals 6, the program jumps out of that loop at line 360 and goes to line 400. Now the child is asked if he wants to enter another number for a new game. If he answers yes (Y), the program goes back to line 20 where K is again set at zero.

The beginning programmer can start trying his own ideas for changing this fundamental program. For instance, suppose you want to eliminate the stars from the display. You could simply delete lines 70 through 150. Perhaps you wish to change lines 190 and 200 which form the column addition format in the North Star BASIC. Maybe your BASIC has a different format procedure such as a PRINTUSING statement.

Another possibility is to change the mathematical operation from addition to subtraction, multiplication or division. You must make several changes throughout the program. You'll have to make the appropriate operational sign changes in lines 170 and 220. You'll probably also wish to eliminate the stars, lines 70 through 150.

If you really want to get playful, you can devise a scoring system with a new variable, call it S, and set it initially at 100. Then each time the child answers a problem correctly, 10 is added to S and for each wrong answer, 10 is deducted. This might be done by adding the following statements:

```
15 LET S = 100; 253 LET S = S - 10; 318 LET S = S + 10;
352 PRINT; 353 PRINT "YOUR CURRENT SCORE IS NOW",S.
```

You may have a better way of setting up a scoring routine. Go ahead, experiment. It's the best way to learn programming. But do let your youngster have a crack at playing this number game once in a while. Remember, micro-bugs come in all sizes.□

SAMPLE RUN

```
THIS IS A NUMBER GAME

ENTER A NUMBER FROM 1 TO 10, 4
* * * *      4

*       1

ENTER THE ANSWER FOR:  4 +  1 =  ?

 4.00
 1.00
?5
                    *** *** *** *** *** *** *** ***
                    *** *** *** *** *** *** *** ***
                    YOU ARE CORRECT---YOU WIN ! ! !
                    *** *** *** *** *** *** *** ***
                    *** *** *** *** *** *** *** ***
 DO YOU WANT ANOTHER GAME? (Y/N), Y
* * * *      4

* *      2
ENTER THE ANSWER FOR:  4 +  2 =  ?
 4.00
 2.00
?7
SORRY, THAT ANSWER IS NOT CORRECT, TRY AGAIN!
* * * *      4

* *      2

ENTER THE ANSWER FOR:  4 +  2 =  ?

 4.00
 2.00
?6
                    *** *** *** *** *** *** *** ***
                    *** *** *** *** *** *** *** ***
                    YOU ARE CORRECT---YOU WIN ! ! !
                    *** *** *** *** *** *** *** ***
                    *** *** *** *** *** *** *** ***
 DO YOU WANT ANOTHER GAME? (Y/N) N

DO YOU WANT TO ENTER ANOTHER NUMBER AND PLAY AGAIN?

(Y/N) N
READY
```

PROGRAM LISTING

```
10 DIM Z$(2)
20 LET K=0
30 PRINT "THIS IS A NUMBER GAME"
35 PRINT\ PRINT\ PRINT\ PRINT
40 INPUT "ENTER A NUMBER FROM 1 TO 10 ",C
50 PRINT\ PRINT
60 LET K=K+1
70 FOR I = 1 TO C
80 PRINT "* ",
90 NEXT I
100 PRINT "    ",C
110 PRINT
120 FOR I = 1 TO K
130 PRINT "* ",
140 NEXT I
150 PRINT "    ",K
160 PRINT
170 PRINT "ENTER THE ANSWER FOR: ",C," + ",K," = "," ?"
180 PRINT
190 PRINT %5F2,C
200 PRINT %5F2,K
210 INPUT A
220 LET A1 = C + K
230 IF A = A1 THEN 270
240 PRINT
250 PRINT "SORRY, THAT ANSWER IS NOT CORRECT, TRY AGAIN!"
255 PRINT\ PRINT
260 GOTO 70
270 FOR I = 1 TO 2
280 PRINT "                    *** *** *** *** *** *** *** *** "
285 PRINT
290 NEXT I
300 PRINT
310 PRINT "                    YOU ARE CORRECT---YOU WIN ! ! ! "
320 PRINT
330 FOR I = 1 TO 2
340 PRINT "                    *** *** *** *** *** *** *** *** "
345 PRINT
350 NEXT I
360 IF K > 5 THEN 400
370 PRINT
380 INPUT " DO YOU WANT ANOTHER GAME? (Y/N) ",Z$
390 IF Z$ = "Y" THEN 60
400 PRINT\ PRINT\ PRINT\ PRINT
410 PRINT "DO YOU WANT TO ENTER ANOTHER NUMBER AND PLAY AGAIN?"
420 PRINT
430 INPUT "(Y/N) ",Z$
440 IF Z$ = "Y" THEN 20
450 END
READY
```

On A Bi-Lingual Math Tutoring Program

By Marvin Mallon

All forms of programming are challenging and unquestionably, if success follows, create a strong feeling of accomplishment. There is a special sense of gratification, however, that can be identified with writing educational programs. The thought of making the computer serve as a tutoring appliance for the school child is quite inspiring. We are certainly on the threshhold of having the microcomputer serve the needs of the business community as it never has before. We will also soon see the influx of personal computers in the home in numbers undreamed of five years ago. Surely then, one of the more worthy causes to be served will be the teaching of the young.

Of course, a lot has happened in this area already, most notably in school districts in Northern California, due to the prodding and patience of Albrecht, Verplank, et al. The proximity of Hewlett-Packard, Digital Equipment Corporation and IBM has not been wasted in the San Jose-Palo Alto school districts, and Los Angeles teachers, if not in fact the rest of the country, look in envy to their achievements. Hopefully, it is only a matter of time before educators everywhere find the means to enhance classroom activities with the aid of the small computer.

A specific area worthy of extra attention is in dealing with minority students. The Los Angeles Unified School District is responsible for the formative education of thousands of such children, and it encounters special problems where language is a barrier. The computer can help. This article demonstrates that a start has been made and urges greater participation elsewhere to produce constructive programs aimed at overcoming language differences as an obstacle.

Specifically, I wrote a Math Tutoring program which helped my daughter and her friends practice basic arithmetic problems. Some time later I sold and installed a number of microcomputers into Los Angeles high schools. At one of these schools, San Fernando High, I met and worked with Alan Samow who is on the staff of the mathematics department. He was delighted to have a copy of my tutoring program and in short order, translated it for use by the Spanish-speaking students in his classes. This simply required re-phrasing the prompt messages, but he went on to enhance the original program with some fine touches of his own. Following this article is a listing of both the English and Spanish versions with a typical run of the Spanish program included as well.

The program opens with a personalized introduction that sets the mood for the intercourse to follow. It then offers ten problems in either addition, subtraction, multiplication or division. The student also limits the largest numbers he or she will work with based on his or her educational level. Multiplication problems have the further option of being created with the same repetitive multiplier should the student wish to practice his "times table". An option of the division choice is the selection of problems with or without odd remainders.

Answers are greeted with either criticism or praise dependent, of course, on the correctness of the response. These are randomized so as to enhance the "personal touch" of the lesson. The student is given three chances at the right answer before the program moves on to the next question. At the end of the exercise a summary is printed of the score and all missed or troublesome problems are recapped. This tends to enforce the lesson and hopefully encourages the user to repeat difficult areas or go on to larger numbers.

The reader is not only encouraged to use these programs as they appear here, but Mr. Samow and I would be especially gratified if others followed our example and translated new or existing programs so as to make them suitably usable by a broader group of students. Surely nothing can be of greater consequence than the promotion of the computer as a learning tool for children of all ages and background. □

SAMPLE RUN

```
RUN
HOLA, CUAL ES TU NOMBRE ?? GERADO
GUSTO EN CONOCERTE GERADO.  VAMOS A PRACTICAR
MATEMATICAS JUNTOS.
PODEMOS HACER SUMAS, RESTAS
MULTIPLICACION Y DIVISIONES.
ESCRIBE UN SIMBOLO Y HAREMOS 10 PROBLEMAS
         +   -   X  OR /
CUAL EJERCICIO ?? +
VAMOS A TRABAJOR CON 2 NUMEROS DIFERENTES
CUAL SERA LA CANTIDAD DEL PRIMER NUMERO ?? 987
CUAL SERA LA CANTIDAD DEL SEGUNDO NUMERO? 87
AQUI HAY UN PROBLEMA DE SUMAR
  # 1                 498
                +       4
                -----------
? 502
MUY BIEN!! CONTINUA ASI.
  # 2                 562
                +      63
                -----------
? 625
ESTA CORRECTO GERADO. TRATA OTRO----
  # 3                 592
                +      65
                -----------
? 34
ESTA INCORRECTO GERADO.
  # 3                 592
                +      65
                -----------
? 785
ESTA INCORRECTO GERADO.
  # 3                 592
                +      65
                -----------
? 345
TUS 3 PREBAS TERMINARON--LO SIENTO!!
 ,# 4                 271
                +      61
                -----------
? 232
ESTA INCORRECTO GERADO.
  # 4                 271
                +      61
                -----------
? 332
MUY BIEN!! CONTINUA ASI.
  # 5                 305
                +      71
                -----------
? 376
ERES MUY INTELEGNETE GERADO. AQUI TENEMOS OTRO.
  # 6                 858
                +      78
                -----------
? 936
MUY BIEN!! CONTINUA ASI.
  # 7                 543
                +      47
                -----------
```

```
? 59Ø
ERES MUY INTELEGNETE GERADO. AQUI TENEMOS OTRO.
  # 8              874
              +     64
              -----------
? 938
MUY BIEN!! CONTINUA ASI.
  # 9              4Ø8
              +     38
              -----------
? 746
ERRASTE GERADO.  TRATA OTRA VEZ.
  # 9              4Ø8
              +     38
              -----------
? 546
ESTA INCORRECTO GERADO.
  # 9              4Ø8
              +     38
              -----------
? 446
ESTA CORRECTO GERADO. TRATA OTRO----
  # 1Ø             1Ø5
              +     67
              -----------
? 172
EXCELENTE-EJERCICIO COMPLETO.

       SUMAR

GERADO TIENES 9 CORRECTO Y 1 INCORRECTOS
TEINES PROBLEMAS CON 3 PROBLEMAS
TU GRADO ES  8Ø

TUVISTE DIFICULTA CON LOS SIGUIENTES PROBLEMAS
       271 + 61 = 332
       4Ø8 + 38 = 446

HIZISTE MAL ESTOS PROBLEMAS
       592 + 65 = 657

TRATAMOS MAS PROBLEMAS ? SI
ESCRIBE UN SIMBOLO Y HAREMOS 1Ø PROBLEMAS
          +   -   X  OR /
CUAL EJERCICIO ?? /
VAMOS A TRABAJOR CON 2 NUMEROS DIFERENTES
CUAL SERA LA CANTIDAD DEL PRIMER NUMERO ?? 898
CUAL SERA LA CANTIDAD DEL SEGUNDO NUMERO? 9
QUIERES PROBLEMAS CON RESIDUO (SOBRANTES)
? NO
AQUI HAY UN PROBLEMA DE DIVICION
# 1 CUANTO ES   342 DIVIDIDO POR 6
? 57
MUY BIEN!! CONTINUA ASI.
# 2 CUANTO ES   119 DIVIDIDO POR 7

? 17
ERES MUY INTELEGNETE GERADO. AQUI TENEMOS OTRO.
# 3 CUANTO ES  74Ø DIVIDIDO POR 5
? 148
MUY BIEN!! CONTINUA ASI.
# 4 CUANTO ES   723 DIVIDIDO POR 3
? 241
MUY BIEN!! CONTINUA ASI.
# 5 CUANTO ES   16Ø DIVIDIDO POR 8
? 2Ø
ERES MUY INTELEGNETE GERADO. AQUI TENEMOS OTRO.

# 6 CUANTO ES   816 DIVIDIDO POR 6
? 136
MUY BIEN!! CONTINUA ASI.
# 7 CUANTO ES   387 DIVIDIDO POR 3
? 129
ESTA CORRECTO GERADO. TRATA OTRO----
# 8 CUANTO ES  24Ø DIVIDIDO POR 4
? 6Ø
MUY BIEN!! CONTINUA ASI.
# 9 CUANTO ES   747 DIVIDIDO POR 3
? 249
ESTA CORRECTO GERADO. TRATA OTRO----
# 1Ø CUANTO ES  57Ø DIVIDIDO POR 5
? 114
EXCELENTE-EJERCICIO COMPLETO.

       DIVICION

GERADO TIENES 1Ø CORRECTO Y Ø INCORRECTOS
TEINES PROBLEMAS CON Ø PROBLEMAS
TU GRADO ES  1ØØ

NINGUN ERROR...TE FELICITO!!

TRATAMOS MAS PROBLEMAS ? NO
HASTA LUEGO POR AHORA.  TE VEO PRONTO!!

OK
```

PROGRAM 1

```
OK
LIST

10 REM - MATH TUTOR PROGRAM
20 REM - WRITTEN BY M. MALLON
30 REM - AUGUST, 1976
100 REM - OPENING DIALOG
110 INPUT "HELLO, WHAT'S YOUR NAME";A$
120 PRINT"GLAD TO MEET YOU ";A$;".  LET'S PRACTICE"
130 PRINT"SOME MATHEMATICS TOGETHER."
200 REM - WHICH DRILL?
210 PRINT"WE CAN DO ADDITION, SUBTRACTION"
220 PRINT"MULTIPLICATION, OR DIVISION."
230 PRINT"TYPE A SYMBOL AND WE WILL DO 10 PROBLEMS:"
232 FOR L=1TO10:P(L)=0:E(L)=0:Q(L)=0:NEXT
234 L=0
235 C=0:N=0:R=0:T=0
237 FOR K=1 TO 10:F(K)=0:G(K)=0:H(K)=0:NEXT
238 K=0
240 PRINT TAB(10);"+  -  X  OR  ÷"
250 INPUT "WHICH WILL IT BE";B$
270 IF B$<>"+"AND B$<>"-"AND B$<>"X"AND B$<>"÷" THEN 240
300 REM - PICKING THE NUMBERS
310 PRINT"WE'LL WORK WITH TWO DIFFERENT NUMBERS"
320 INPUT"HOW BIG CAN THE FIRST ONE BE";N1
332 IF N1=<0 OR N1 >1000 THEN 380
340 INPUT"HOW BIG CAN THE OTHER NUMBER BE";N2
352 IF N2=<0 OR N2 >1000 THEN 380
360 GOTO 400
380 PRINT"THE NUMBERS HAVE TO BE BETWEEN 1 AND 1000"
385 PRINT"LET'S TRY AGAIN----"
390 GOTO 320
400 REM - GOTO DRILL ROUTINE
410 IF B$="+" THEN 600
420 IF B$="-" THEN 700
430 IF B$="X" THEN 800
440 GOTO 900

600 REM - ADDITION
615 S$="PLUS":R$="ADDITION"
620 PRINT"HERE'S AN ADDITION PROBLEM FOR YOU---"
625 GOSUB 1500
630 GOSUB 1000
635 W=A+B
640 IF X=W THEN GOSUB 3000
650 IF X=W THEN 625
660 GOSUB 4000
665 IF X<>A+B AND T=3 THEN 625
670 GOTO 630
700 REM - SUBTRACTION
710 PRINT"HERE'S A PROBLEM IN SUBTRACTION."
715 S$="MINUS"
718 R$="SUBTRACTION"
720 GOSUB 1500
740 IF B>A THEN Y=A:A=B:B=Y
750 GOSUB 1000
760 W=A-B
770 IF X=W THEN GOSUB 3000
780 IF X=W THEN 720
790 GOSUB 4000
795 IF X<>W AND T=3 THEN 720
797 GOTO 750
800 REM - MULTIPLICATION
815 S$="TIMES":R$="MULTIPLICATION"
816 PRINT"DO YOU WANT TO PRACTICE WITH A SPECIAL NUMBER";
817 INPUT C$
818 IF C$="YES" THEN INPUT "WHAT IS THE NUMBER";A
819 IF C$="YES" THEN GOSUB 1510
820 IF C$="YES" THEN GOTO 850
822 PRINT"HERE'S A MULTIPLICATION PROBLEM FOR YOU."
830 GOSUB 1500
850 GOSUB 1000
855 W=A*B
860 IF X=W THEN GOSUB 3000
870 IF X=W AND C$="YES" THEN GOTO 819
875 IF X=W AND C$<>"YES" THEN GOTO 830
880 GOSUB 4000
885 IF X<>W AND T=3 AND C$="YES" THEN GOTO 819
887 IF X<>W AND T=3 AND C$<>"YES" THEN GOTO 830
890 GOTO 850
900 REM - DIVISION
910 S$="DIVIDED BY"
912 R$="DIVISION"
913 U=0
914 PRINT "DO YOU WANT PROBLEMS WITH REMAINDERS";
915 INPUT V$
916 IF V$="YES" THEN U=1
920 PRINT"HERE'S A PROBLEM IN DIVISION."
930 GOSUB 1500
950 IF B>A THEN Y=A:A=B:B=Y
955 IF U=1 THEN 970
960 Z=INT(A/B):A=B*Z
965 IF A=B THEN 930
970 GOSUB 1000
980 W=INT((A/B)*100)/100
982 IF X>(W-.01)AND X<(W+.01)THEN GOSUB 3000
984 IF X>(W-.01)AND X<(W+.01)THEN 930
986 GOSUB 4000
988 IF X<>W AND T=3 THEN 930
990 GOTO 970
1000 REM - ASK THE QUESTION
1010 PRINT"  #";N+1;" HOW MUCH IS";A;S$;B;:INPUT X
1020 RETURN

1490 REM - CREATE RANDOM NUMBERS
1500 A=INT((N1-2)*RND(1)+2)
1510 B=INT((N2-2)*RND(1)+2)
1520 T=0:RETURN
1990 REM - EXERCISE CONCLUDED
1991 POKE 2020,223:POKE 1234,1
1993 PRINT
1995 PRINTTAB(6);R$:PRINT
2000 PRINTA$;" YOU GOT";C;"RIGHT AND";N-C;"WRONG."
2005 PRINT"YOU HAD TROUBLE WITH";L+K;"PROBLEMS."
2010 PRINT"YOUR SCORE IS";INT(C/N*100)-(5*L)
2020 PRINT:S=L
2022 IFH(1)=0ANDL=0THENPRINT"NO MISTAKES--CONGRATULATIONS!":GOTO2065
2026 PRINT"YOU HAD DIFFICULTY WITH THESE PROBLEMS:"
2027 FOR L=1 TO S
2028 PRINTTAB(6);P(L);S$;E(L);"=";Q(L)
2029 NEXT
2030 L=0:PRINT
2032 IF H(1)=0 THEN GOTO 2062
2038 PRINT"YOU MISSED THESE PROBLEMS:"
2040 FOR K=1 TO N-C
2050 PRINTTAB(6);F(K);S$;G(K);"=";H(K)
```

```
2060 NEXT K
2062 K=0
2064 PRINT
2065 POKE 1234,0:POKE 2020,0
2070 INPUT "SHALL WE TRY SOME MORE";D$
2080 IF D$="YES" THEN 230
2090 IF D$ ="NO" THEN 9000
2095 PRINT"YOU MUST ANSWER YES OR NO PLEASE.":GOTO 2070
3000 REM - CORRECT ANSWER!
3010 T=0:C=C+1:N=N+1
3012 M=0
3015 IF N=10 THEN PRINT"EXCELLENT--EXERCISE IS COMPLETE!":GOTO1990
3020 R=INT((4-1)*RND(1)+1)
3040 ON R GOTO 3050,3070,3090
3050 PRINT"THAT'S RIGHT ";A$;". TRY ANOTHER---"
3060 RETURN
3070 PRINT"THAT'S VERY GOOD! KEEP IT UP."
3080 RETURN
3090 PRINT"YOU'RE SURE SMART ";A$;". HERE'S ANOTHER--"
3110 RETURN
4000 REM - WRONG ANSWER
4010 T=T+1
4015 IF T=2 THEN 4030
4020 IF T=3 THEN 5000
4022 M=1
4025 L=L+1:P(L)=A:E(L)=B:Q(L)=W
4030 R=INT((4-1)*RND(1)+1)
4040 ON R GOTO 4050,4070,4090
4050 PRINT"YOU GOOFED ";A$;". TRY AGAIN."
4060 RETURN
4070 PRINT"THAT'S WRONG ";A$;"."
4080 RETURN
4090 PRINT"THINK AGAIN---"
4095 RETURN
5000 REM - 3 MISSES
5010 PRINT"YOUR 3 TRIES ARE UP----TOO BAD."
5020 N=N+1:K=K+1
5030 IF M=1 THEN L=L-1
5040 F(K)=A:G(K)=B
5042 H(K)=W
5045 IF N<10 THEN RETURN
5050 GOTO 1990
9000 PRINT"GOODBYE FOR NOW. SEE YOU SOON, I HOPE!"
                                                  OK
```

PROGRAM 2

```
10 REM - MATH TUTOR PROGRAM
20 REM ORIGINAL PROGRAM BY MARVIN MALLON
25 REM RE-WRITTEN AND PREPARED BY ALAN SAMOW SFHS
27 REM TRANSLATION BY LACS
30 REM - AUGUST, 1976
100 REM - OPENING DIALOG
110 INPUT "HOLA, CUAL ES TU NOMBRE ?";A$
120 PRINT "GUSTO EN CONOCERTE ";A$;".  VAMOS A PRACTICAR"
130 PRINT"MATEMATICAS JUNTOS."
200 REM - WHICH DRILL?
210 PRINT"PODEMOS HACER SUMAS, RESTAS"
220 PRINT "MULTIPLICACION Y DIVISIONES."
230 PRINT "ESCRIBE UN SIMBOLO Y HAREMOS 10 PROBLEMAS"
232 FOR L=1TO10;P(L)=0:E(L)=0:Q(L)=0:NEXT
234 L=0
235 C=0:N=0:R=0:T=0
237 FOR K=1 TO 10:F(K)=0:G(K)=0:H(K)=0:NEXT
238 K=0
240 PRINT TAB(10);" +   -   X  OR / "
250 INPUT "CUAL EJERCICIO ?";B$
270 IF B$<> "+"AND B$<>"-"AND B$<>"X"AND B$<>"/" THEN 240
300 REM - PICKING THE NUMBERS
310 PRINT"VAMOS A TRABAJOR CON 2 NUMEROS DIFERENTES"
320 INPUT "CUAL SERA LA CANTIDAD DEL PRIMER NUMERO ?";N1
332 IF N1=<0 OR N1 >1000 THEN 380
340 INPUT"CUAL SERA LA CANTIDAD DEL SEGUNDO NUMERO";N2
352 IF N2=<0 OR N2 >1000 THEN 380
360 GOTO 400
380 PRINT"LOS NUMEROS TIENES QUE ESTAR ENTRE DEL 1 A 1000"
385 PRINT "VAMOS A TRATAR"
390 GOTO 320
400 REM - GOTO DRILL ROUTINE
410 IF B$="+" THEN 600
420 IF B$="-" THEN 700
430 IF B$="X" THEN 800
440 GOTO 900
600 REM - ADDITION
615 S$="+":R$="SUMAR"
620 PRINT "AQUI HAY UN PROBLEMA DE SUMAR"
625 GOSUB 1500
630 GOSUB 1000
635 W=A+B
640 IF X=W THEN GOSUB 3000
650 IF X=W THEN 625
660 GOSUB 4000
665 IF X<>A+B AND T=3 THEN 625
670 GOTO 630
700 REM - SUBTRACTION
710 PRINT "AQUI HAY UN PROBLEMA DE RESTAR"
715 S$="-"
718 R$="RESTAR"
720 GOSUB 1500
740 IF B>A THEN Y=A:A=B:B=Y
750 GOSUB 1000
760 W=A-B
770 IF X=W THEN GOSUB 3000
780 IF X=W THEN 720
790 GOSUB 4000
795 IF X<>W AND T=3 THEN 720
797 GOTO 750
800 REM - MULTIPLICATION
815 S$="X":R$="MULTIPLICACION"
816 PRINT "QUIERES PRACTICAR CON NUMEROS ESPECIALES"
817 INPUT C$
818 IF C$="SI" THEN INPUT "CUAL ES EL NUMERO";A
```

```
819 IF C$="SI" THEN GOSUB 1510
820 IF C$="SI" THEN GOTO 850
822 PRINT "AQUI HAY UN PROBLEMA DE MULTIPLICACION"
830 GOSUB 1500
850 GOSUB 1000
855 W=A*B
860 IF X=W THEN GOSUB 3000
870 IF X=W AND C$="SI" THEN GOTO 819
875 IF X=W AND C$<>"SI" THEN GOTO 830
882 GOSUB 4000
885 IF X<>W AND T=3 AND C$="SI" THEN GOTO 819
887 IF X<>W AND T=3 AND C$<>"SI" THEN GOTO 830
890 GOTO 850
900 REM - DIVISION
910 S$="DIVIDIDO POR"
912 R$="DIVICION"
913 U=0
914 PRINT "QUIERES PROBLEMAS CON RESIDUO (SOBRANTES)"
915 INPUT V$
916 IF V$="SI" THEN U=1
920 PRINT "AQUI HAY UN PROBLEMA DE DIVICION"
930 GOSUB 1500
950 IF B>A THEN Y=A:A=B:B=Y
955 IF U=1 THEN 970
960 Z=INT(A/B):A=B*Z
965 IF A=B THEN 930
970 GOSUB 1100
980 W=INT((A/B)*100)/100
982 IF X>(W-.01)AND X<(W+.01)THEN GOSUB 3000
984 IF X>(W-.01)AND X<(W+.01)THEN 930
986 GOSUB 4000
988 IF X<>W AND T=3 THEN 930
990 GOTO 970
1000 REM ASK THE QUESTION
1001 IF A<10 THEN Z=22:GOTO 1005
1002 IF A<100 THEN Z=21:GOTO 1005
1003 Z=20
1005 IF B<10 THEN O=22:GOTO 1010
1006 IF B<100 THEN O=21:GOTO 1010
1007 O=20
1010 PRINT "  #";N+1;
1012 PRINT TAB(Z);A
1014 PRINT TAB(15);S$;SPC(O-16);B
1015 PRINT TAB(15);"-----------"
1016 INPUT X
1020 RETURN
1100 REM ASK DIVISION QUESTION
1110 PRINT "#";N+1;"CUANTO ES "A;S$;B:INPUT X
1115 RETURN
1490 REM - CREATE RANDOM NUMBERS
1500 A=INT((N1-2)*RND(1)+2)
1510 B=INT((N2-2)*RND(1)+2)
1520 T=0:RETURN
1990 REM - EXERCISE CONCLUDED
1993 PRINT
1995 PRINTTAB(6);R$:PRINT
2000 PRINT A$;" TIENES";C;"CORRECTO Y";N-C;"INCORRECTOS"
2005 PRINT "TEINES PROBLEMAS CON";L+K;"PROBLEMAS"
2010 PRINT "TU GRADO ES ";INT(C/N*100)-(5*L)
2020 PRINT:S=L
2022 IFH(1)=0ANDL=0THEN PRINT "NINGUN ERROR...TE FELICITO!!"
2023 IFH(1)=0AND L=0 THEN 2062
2026 PRINT"TUVISTE DIFICULTA CON LOS SIGUIENTES PROBLEMAS"
2027 FOR L=1 TO S
2028 PRINTTAB(6);P(L);S$;E(L);"=";Q(L)
2029 NEXT
2030 L=0:PRINT
2032 IF H(1)=0 THEN GOTO 2062
2038 PRINT "HIZISTE MAL ESTOS PROBLEMAS"
2040 FOR K=1 TO N-C
2050 PRINTTAB(6);F(K);S$;G(K);"=";H(K)
2060 NEXT K
2062 K=0
2064 PRINT
2070 INPUT "TRATAMOS MAS PROBLEMAS ";D$
2080 IF D$="SI" THEN 230
2090 IF D$="NO" THEN 9000
2095 PRINT"YOU MUST ANSWER YES OR NO PLEASE.":GOTO 2070
3000 REM - CORRECT ANSWER!
3010 T=0:C=C+1:N=N+1
3012 M=0
3015 IFN=10 THEN PRINT"EXCELENTE-EJERCICIO COMPLETO.":GOTO1990
3020 R=INT((4-1)*RND(1)+1)
3040 ON R GOTO 3050,3070,3090
3050 PRINT "ESTA CORRECTO ";A$;". TRATA OTRO----"
3060 RETURN
3070 PRINT "MUY BIEN!! CONTINUA ASI."
3080 RETURN
3090 PRINT "ERES MUY INTELEGNETE ";A$;". AQUI TENEMOS OTRO."
3110 RETURN
4000 REM - WRONG ANSWER
4010 T=T+1
4015 IF T=2 THEN 4030
4020 IF T=3 THEN 5000
4022 M=1
4025 L=L+1:P(L)=A:E(L)=B:Q(L)=W
4030 R=INT((4-1)*RND(1)+1)
4040 ON R GOTO 4050,4070,4090
4050 PRINT "ERRASTE ";A$;".  TRATA OTRA VEZ."
4060 RETURN
4070 PRINT "ESTA INCORRECTO ";A$;"."
4080 RETURN
4090 PRINT "PIENSA OTRA VEZ"
4095 RETURN
5000 REM - 3 MISSES
5010 PRINT "TUS 3 PREBAS TERMINARON--LO SIENTO!!"
5020 N=N+1:K=K+1
5030 IF M=1 THEN L=L-1
5040 F(K)=A:G(K)=B
5042 H(K)=W
5045 IF N<10 THEN RETURN
5050 GOTO 1990
9000 PRINT "HASTA LUEGO POR AHORA.  TE VEO PRONTO!!"
                                                 OK
```

COPY/SORT/SEARCH:

In a recent environmental control project, I was confronted by the task of maintaining a RAM-resident data file which represents the system's "internal model of the world". The 8080 software package was responsible for continual updating of the data file, as well as a wide variety of manipulations involving the information therein. Since the system was to exist in a busy real-time environment, processing time required for data manipulation would be a significant, and troublesome, overhead factor.

The difficulty becomes obvious when the nature of the system's interface with the world is considered. The data file must accommodate upwards of a thousand points, each formatted as shown in the top illustration of Figure 1. Updating of the variable data field and associated flags is accomplished by polling the host system, which serves as a data concentrator and primary controller for the environmental equipment. If the polling were a straightforward sequential affair, handling of the file would be easy. Unfortunately, data arrives from the host system not only as a function of routine requests from the 8080 software, but also as a random and asynchronous result of alarm conditions, changes of equipment status, and certain times of day. It is therefore impossible to predict the data's destination in the table without a search to associate its point number with the corresponding address in the file.

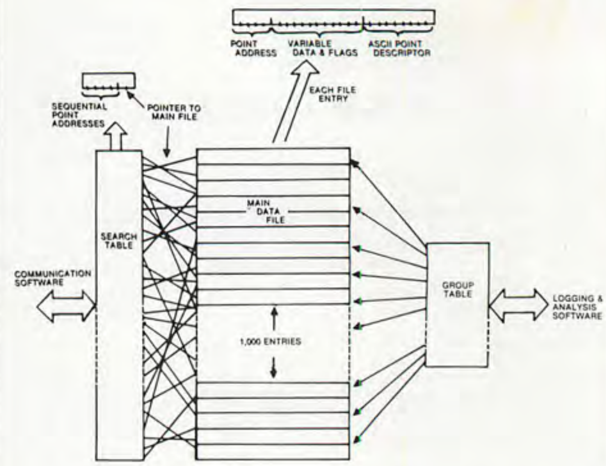


Figure 1.

It was not long in the development of the software before it became obvious that sequential search was a thoroughly unacceptable solution. The scan of the table took so long that new data transmitted from the host system was lost. A more efficient search algorithm was necessary. A binary search was clearly the best, but its implementation was complicated by the fact that the point addresses in the data file were not sequential; nor could they be made so, as the system's data reduction functions such as logging and trend analysis depended upon the logical groupings of the data as shown in Figure 2. But without the speed advantages of binary search, the data collection would be slowed so drastically that it would no longer be of any use in a real-time system.

Before venturing into the solution to the apparent impasse, let's take a quick look at the concept of binary search to see why it is so much more desirable than its sequential counterpart.[4] Assuming that we have a list of 100 numbers, how can we determine the location in the list of any one of the members? It is a simple matter to start at the top of the list and compare the input number to each entry until we find one that is equal. The problem here, of course, is time. The worst-case number of comparisons is 100, with an average of 50. However, we could arrange the list so that the numbers are sequentially ordered, then take a completely different search strategy. Given the input number, we examine the midpoint of the list. If the value in question is larger than that at midpoint, we may discard the first half of the list and concentrate our search on the second.

By a single comparison, we have halved the magnitude of the searching task rather than reduced it by 1% as

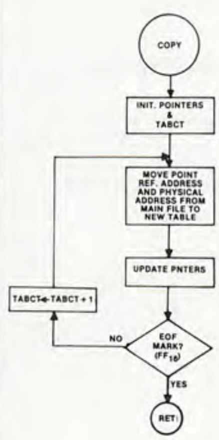


Figure 3a.

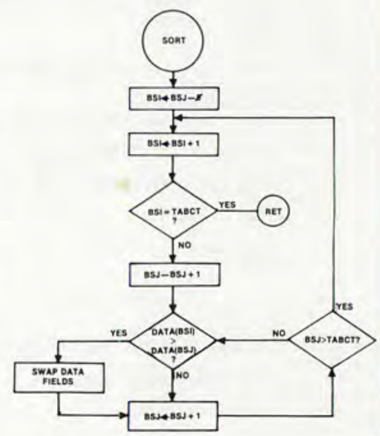


Figure 3b.

```
ALL-POINTS LOG

DAVIDSON HALL AHU-1
01 SF.... AL  OFF         02 SF.... 434. HRS
03 RF(S). NM  OFF         04 RF(N). NM  OFF
05 HD.... 095 DEG         06 CD.... 068 DEG

DAVIDSON HALL AHU-2
01 SF.... AL  OFF         02 SF...  237. HRS
03 RF(S). NM  OFF         04 RF(N). NM  OFF
05 HD.... 086 DEG         06 CD.... 072 DEG

DAVIDSON HALL AHU-3
01 SF.... AL  OFF         02 SF.... 310. HRS
03 RF(S). NM  OFF         04 RF(N). NM  OFF
05 HD.... 078 DEG         06 CD.... 075 DEG

DAVIDSON HALL PUMPS
01 HWP1.. NM  ON          02 HWP1.. 284. HRS
03 HWP2.. NM  OFF         04 HWP2.. 334. HRS
05 CWP1.. NM  OFF         06 CWP1.. .000HRS
07 CWP2.. NM  OFF         08 CWP2.. .000HRS

DAVIDSON HALL SPACE
01 2FL... 071 DEG         02 O.A... 054 DEG
```

Figure 2.

before. The next step is to look at the midpoint of the remaining list, discarding the appropriate half again. This simple procedure is repeated until the number sought is found. With 100 elements in the list, the maximum number of comparisons is 7. Conceptually, that's all there is to it. The actual algorithm will be described shortly.

Back to the real-time environmental control system with the awkward data file. The information therein is referenced by 5-character point addresses. These are scattered about the table in no dependable order. Suppose we generate an intermediate lookup table which contains the point addresses sorted numerically, each associated with its corresponding physical address in the data file. This approach would yield a compact indexing table to which could be applied the binary search technique. If the new table were to be automatically regenerated each time the system was cold-started, expansion or modification of the main file structure would create no problems. The software requirements for the solution to the problem are now clearly defined:

- A COPY routine to generate the intermediate table from the point addresses and physical addresses in the main data file.
- A SORT routine to organize the new table into a sequential list, based upon the values of the five-character numeric point addresses.
- A SEARCH routine to perform a binary search on the new table whenever data is transmitted to the system, yielding a pointer to the actual location of the referenced file entry.

8080 DATA MANIPULATION

By Steven K. Roberts

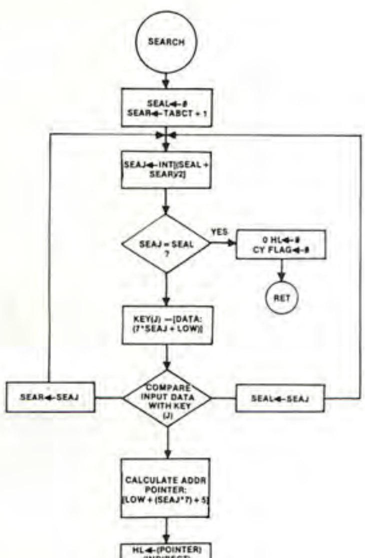


Figure 3c.

COPY and SORT are called in succession whenever the system is initialized, and SEARCH is used with each reception of data. The total package is a flexible table-manipulation system and, excluding a standard utility package which is called in a few places[1], requires less than 350 bytes of code.

Refer to the flowchart in Figure 3a. The COPY routine is almost trivial; pointers are set up to address the main file and the table-to-be, then incremented by appropriate values as the reference addresses and physical addresses are moved from one to the other. (In the specific application which engendered this software, the file entry size was 26 bytes and the reference addresses were 5 bytes, as noted in Figure 1. Modification to accommodate other parameters is straightforward and should be clear from the comments in the listing.) As the transfer of addresses is taking place, a counter (TABCT) is incremented, yielding the table size at the completion of the COPY phase.

The end of the main file is flagged with an FF_H, so addition of new elements does not require any software changes. Upon detection of this flag, COPY is exited. At this time an unsorted intermediate table exists, with its number of elements defined by TABCT.

The initialization software then proceeds directly to a call of SORT. The sorting routine shown here (Figure 3b) is

not the world's most efficient (although perhaps the opposite), as it is the Bubble Sort. There are numerous faster algorithms, notably the Shell-Metzner and modifications thereto[2], but in an application such as this where the sort is executed only upon system initialization, speed is not highly critical. If your application must accommodate dynamically changing the data file dimensions, implementation of the Shell-Metzner is recommended.

Basically, the bubble sort "floats" numbers to the top of the table if they are found to be smaller than the ones presently in a lower-order position. Two pointers (BSI and BSJ) are indexed in a sequence which allows comparison of all combinations of table elements; if the pair under scrutiny are found to be incorrectly ordered, they are swapped. The pointers are periodically compared to TABCT, and when they have both arrived at the table's end, the sort is complete.

A note should be inserted at this point about the utility package called in places by this software. Written by Charles Howerton of Digital Group Software Systems, BARC (for Broad Application Routine Coding) is a 256-byte, self-modifying block of code which performs such useful functions as string compare, swap, move, fill, and other operations which take some of the sting out of not using a Z-80. A well commented listing has been published[3] and should be referenced if serious use of this software is intended.

Following the system's call of COPY and SORT, an ordered intermediate search table exists. At this time, operation of the various communication and control functions may begin, with the facility for rapid indexing of data file elements via SEARCH.

As shown in the flowchart (Figure 3c), the search routine initializes two pointers, one to the beginning of the table and one to the end. These are called, respectively, SEAL (left) and SEAR (right). On the basis of these limit pointers, a "middle" pointer (SEAJ) is calculated by taking the integer value of their sum divided by two. A check is made to determine possible end of search, then the input data is compared to the table entry at SEAJ. The results of the comparison are used to select one of three possible operations: a) discard the first half of the table, b) discard the second half of the table, or c) terminate the search if the comparison yielded an equal condition. In the latter case, the two byte physical address is located which corresponds to the newly found point address, and the routine is exited with this index value in H&L. The calling software then simply references the file at the specified location and performs the update of the information therein.

The implementation of this technique in the environmental control application was quite successful. The concept is intrinsically flexible and allows the advantages of binary search and other ordered operations in a software environment characterized by an unsortable data file. The intermediate search table organizes the file access as a function of the available reference addresses; in applications where even *this* is variable, there is no reason not to have more than one index table. Even multi-dimensional indexing becomes quite straightforward when using this design philosophy.□

REFERENCES

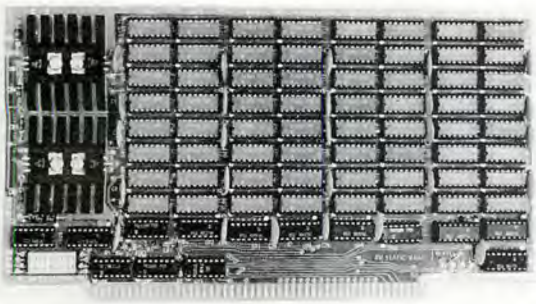
1. BARC (Broad Application Routine Coding), copyright by Charles Howerton, DGSS.
2. Grillo, John P. "A Comparison of Sorts". *Creative Computing,* Nov-Dec 76.
3. Howerton, Charles. "Add Some BASIC to Your 8080". *Byte,* Feb 77.
4. Knuth, Donald E. "Algorithms". *Scientific American,* April 77.

PROGRAM LISTING

```
                 ;
                 ;                    <<< COPY >>>
                 ;
                 ;THIS ROUTINE GENERATES THE INTERMEDIATE SEARCH
                 ;TABLE (UNSORTED) THAT WILL BE USED TO REFERENCE
                 ;THE MAIN FILE.  EACH SEVEN CHARACTER ENTRY IN
                 ;THE TABLE CONSISTS OF A FIVE CHARACTER REFERENCE
                 ;ADDRESS TO THE FILE AND THE CORRESPONDING TWO
                 ;BYTE PHYSICAL ADDRESS.
                 ;
                 ;
0000 210050      COPY:   LXI     H,LOW    ;(BASE ADDRESS OF NEW TABLE)
0003 221500              SHLD    HIGH     ;INITIALIZE TABLE POINTER
0006 210080              LXI     H,FILE   ;(BASE ADDRESS OF MAIN FILE)
0009 221700              SHLD    COPTS    ;INITIALIZE FILE POINTER
000C 210000              LXI     H,0
000F 224400              SHLD    TABCT    ;INITIALIZE TABLE COUNTER
0012 CD5301      COPLP:  CALL    MVCHR    ;COPY LOOP:
0015 0000        HIGH:   DW      0        ;  PERFORM MOVE
0017 0000        COPTS:  DW      0        ;  OF FIVE CHAR. ADDRESS
0019 05                  DB      5
001A 2A1500              LHLD    HIGH     ;ADD 5 TO TABLE POINTER
001D 110500              LXI     D,5
0020 19                  DAD     D
0021 2A1700              LHLD    COPTS    ;STORE PHYSICAL FILE ADDRESS
0024 EB                  XCHG             ;  IN NEW TABLE
0025 73                  MOV     M,E
0026 23                  INX     H
0027 72                  MOV     M,D
0028 23                  INX     H
0029 221500              SHLD    HIGH     ;UPDATE TABLE POINTER
002C 2A1700              LHLD    COPTS    ;ADD 26 TO FILE POINTER
002F 111A00              LXI     D,26
0032 19                  DAD     D
0033 221700              SHLD    COPTS
0036 3EFF                MVI     A,0FFH   ;IF END OF FILE, RETURN
0038 BE                  CMP     M
0039 C8                  RZ
003A 2A4400              LHLD    TABCT    ;OTHERWISE,
003D 23                  INX     H        ;  INCREMENT TABLE COUNTER
003E 224400              SHLD    TABCT
0041 C31200              JMP     COPLP    ;  AND LOOP.
                 ;
0044 0000        TABCT:  DW      0        ;TABLE COUNTER
                 ;
                 ;
                 ;
                 ;                    <<< BUBBLE SORT >>>
                 ;
                 ;THIS ROUTINE NUMERICALLY SORTS THE INTERMEDIATE
                 ;SEARCH TABLE BEGINNING AT <LOW>, AS A FUNCTION
                 ;OF THE FIVE CHARACTER ASCII FILE REFERENCE ADDRESS.
                 ;THE UNSORTED TABLE GENERATED BY <<COPY>> IS
                 ;REPLACED BY A SORTED TABLE.
                 ;
                 ;
0046 2A4400      SORT:   LHLD    TABCT
0049 23                  INX     H        ;INCREMENT TABLE COUNTER
004A 224400              SHLD    TABCT    ;  TO SATISFY FINAL PARAMETERS
004D 22D000              SHLD    BSN      ;BSN <- TABLE SIZE
0050 210000              LXI     H,0
0053 22CC00              SHLD    BSI      ;BSI <- 0
0056 22CE00              SHLD    BSJ      ;BSJ <- 0
0059 2ACC00      BSRT1:  LHLD    BSI      ;BSI <- BSI+1
005C 23                  INX     H
005D 22CC00              SHLD    BSI
0060 EB                  XCHG             ;BSI=BSN?
0061 2AD000              LHLD    BSN
0064 7A                  MOV     A,D
0065 BC                  CMP     H
0066 C26C00              JNZ     BSRT2
0069 7B                  MOV     A,E
006A BD                  CMP     L
006B C8                  RZ               ;IF SO, WE'RE DONE
006C 2ACC00      BSRT2:  LHLD    BSI      ;BSJ <- BSI+1
006F 23                  INX     H
0070 22CE00              SHLD    BSJ
0073 2ACC00      BSRT3:  LHLD    BSI      ;CALCULATE BSDI & BSDL
0076 CDC200              CALL    MULT7
0079 11F94F              LXI     D,LOW-7
007C 19                  DAD     D   .
007D 229600              SHLD    BSDI     ;BSDI <- 7*BSI+LOW-7
0080 22A100              SHLD    BSWPI    ;(SWAP ADDRESS)
0083 2ACE00              LHLD    BSJ
0086 CDC200              CALL    MULT7
0089 11F94F              LXI     D,LOW-7
008C 19                  DAD     D
008D 229800              SHLD    BSDJ     ;BSDJ <- 7*BSJ+LOW-7
0090 22A300              SHLD    BSWPJ    ;(SWAP ADDRESS)
0093 CD5501              CALL    CLCHR    ;COMPARE 5 CHARACTER FIELDS
0096 0000        BSDI:   DW      0        ;  INDEXED BY BSDI
0098 0000        BSDJ:   DW      0        ;  AND BSDJ (DATA POINTERS)
009A 05                  DB      5
009B D2A600              JNC     BSRT4
009E CD5701              CALL    SWCHR    ;IF D(I) > D(J), SWAP
00A1 0000        BSWPI:  DW      0
00A3 0000        BSWPJ:  DW      0        ;  FULL SEVEN CHAR. FIELDS
00A5 07                  DB      7
00A6 2ACE00      BSRT4:  LHLD    BSJ      ;BSJ <- BSJ+1
00A9 23                  INX     H
00AA 22CE00              SHLD    BSJ
00AD 2AD000              LHLD    BSN      ;IF BSJ=BSN+1, GO TO MAJOR LOOP
00B0 23                  INX     H
00B1 EB                  XCHG
00B2 2ACE00              LHLD    BSJ
00B5 7A                  MOV     A,D
00B6 BC                  CMP     H
```

Wondering which memory is best for you?

base 2• offers the following products to the S-100 market at the industry's lowest prices:

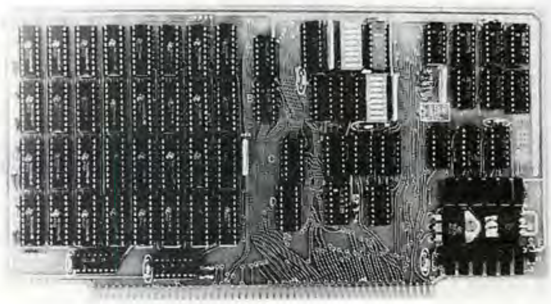


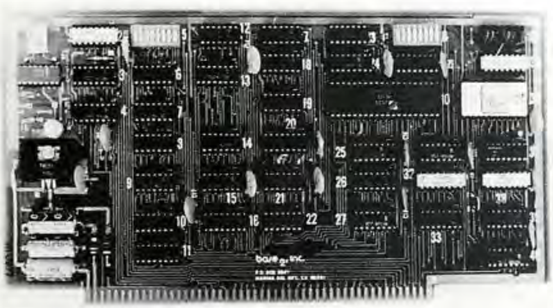
8K Static Memory Board

This 8K board is available in two versions. The 8KS-B operates at 450ns for use with 8080 and 8080A microprocessor systems and Z-80 systems operating at 2MHz. The 8KS-Z operates at 250ns and is suitable for use with Z-80 systems operating at 4MHz. Both kits feature factory fresh 2102's (low power on 8KS-B) and includes sockets for all IC's. Support logic is low power Schottky to minimize power consumption. Address and data lines are fully buffered and 4K bank addressing is DIP switch selectable. Memory Protect/Unprotect, selectable wait states and battery backup are also designed into the board. Circuit boards are solder masked and silk-screened for ease of construction. These kits are the best memory value on the market! Available from stock . . . **8KS-B $125** (assembled and tested add $25.00)
8KS-Z $145 (assembled and tested add $25.00)

16K Static Memory Board

Base 2 can now offer the same price/performance in a 16K static RAM as in its popular 8K RAM. This kit includes 8K bank addressing with 4K boundary address setting on DIP switches. This low power unit provides on-board bank selection for unlimited expansion . . . No MUX board required. Using highest quality boards and components we expect this kit to be one of the most popular units on the market. Available in two speed ranges, the 16KS-B operates at 450ns while the 16KS-Z operates at 250ns.
16KS-B $285 (assembled and tested add $25.00)
16KS-Z $325 (assembled and tested add $25.00)



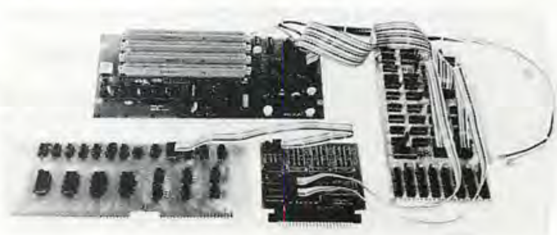


Z-80 CPU Board

Our Z-80 card is also offered in two speed ranges. The CPZ-1 operates at 2MHz and the CPZ-2 operates at 4MHz. These cards offer the maximum in versatility at unbelievably low cost. A socket is included on the board for a 2708 EPROM which is addressable to any 4K boundary above 32K. The power-on jump feature can be selected to address any 4K boundary above 32K or the on-board 2708. An On-board run-stop flip-flop and optional generation of Memory Write allows the board to run with or without a front panel. The board can be selected to run in either the 8080 mode, to take advantage of existing software, or in the Z-80 mode for maximum efficiency. For use in existing systems, a wait state may be added to the M1 cycle, Memory request cycle, on-board ROM cycle, input cycle and output cycle. DMA grant tri-states all signals from the processor board. All this and more on top quality PC boards, fully socketed with fresh IC's. **CPZ-1 $110 CPZ-2 $125**

S-100 for Digital Group Systems

This kit offers, at long last, the ability to take advantage of S-100 products within your existing Digital Group mainframe. Once installed, up to four S-100 boards can be used in addition to the existing boards in the D.G. system. The system includes an "intelligent" mother board, ribbon cables to link existing D.G. CPU to the DGS-100 board and a power wiring harness. The DGS-100 is designed to fit in the 5-3/4" x 12" empty area in the standard D.G. cabinet. It may seem expensive but there's a lot here! End your frustration! **DGS-100 $295**



base 2. inc.

Send for more details on these products. Get on our mailing list for information on more soon to be announced products at factory-direct prices from BASE 2. Why pay more when you can get the best at these prices???

P.O. Box 3548 • Fullerton, Calif. 92634
(714) 992-4344
CA residents add 6% tax
MC/BAC accepted • FOB — U.S. destination

```
00B7 C27300           JNZ   BSRT3     ;OTHERWISE, GO TO MINOR LOOP
00BA 7B               MOV   A,E
00BB BD               CMP   L
00BC C27300           JNZ   BSRT3
00BF C35900           JMP   BSRT1
                ;
00C2 54         MULT7: MOV  D,H       ;CALL WITH NUMBER TO BE
00C3 5D               MOV   E,L       ;MULTIPLIED BY 7 IN [HL]
00C4 0606             MVI   B,6
00C6 19         M7LOO: DAD  D
00C7 05               DCR   B
00C8 C2C600           JNZ   M7LOO
00CB C9               RET             ;RESULT IN [HL]
                ;
00CC 0000       BSI:  DW    0
00CE 0000       BSJ:  DW    0
00D0 0000       BSN:  DW    0
                ;
                ;
                ;
                ;
                ;
                ;               <<< BINARY SEARCH >>>
                ;
                ;THIS ROUTINE PERFORMS BINARY SEARCH OF THE DATA FILE'S
                ;INTERMEDIATE REFERENCE TABLE, GIVEN INPUT FIVE
                ;CHARACTER REFERENCE ADDRESS LOCATED IN <CMPBF>.
                ;OUTPUT IN [HL] IS (0) IF THE ENTRY WAS NOT FOUND,
                ;OR THE MAIN FILE PHYSICAL ADDRESS IF THE SEARCH
                ;WAS SUCCESSFUL.  IN ADDITION, THE [CY] FLAG IS
                ;SET IF SUCCESSFUL, RESET IF NOT.
                ;
                ;
00D2 210000     SERCH: LXI  H,0       ;SEAL <- 0
00D5 224601           SHLD  SEAL
00D8 2A4400           LHLD  TABCT     ;SEAR <- TABCT+1
00DB 23               INX   H
00DC 224801           SHLD  SEAR
00DF 2A4601     SEALP: LHLD SEAL      ;SEAJ <- (SEAL+SEAR)/2
00E2 EB               XCHG            ;  (INTEGER)
00E3 2A4801           LHLD  SEAR
00E6 19               DAD   D
00E7 A7               ANA   A
00E8 7C               MOV   A,H
00E9 1F               RAR
00EA 67               MOV   H,A
00EB 7D               MOV   A,L       ; (DOUBLE-PRECISION ROTATE)
00EC 1F               RAR
00ED 6F               MOV   L,A
00EE 224A01           SHLD  SEAJ
00F1 EB               XCHG
00F2 2A4601           LHLD  SEAL      ;IF SEAJ=SEAL, GO EXIT
00F5 7A               MOV   A,D
00F6 BC               CMP   H
00F7 C2FF00           JNZ   SEACO
00FA 7B               MOV   A,E
00FB BD               CMP   L
00FC CA2F01           JZ    SEXIT
00FF 2A4A01     SEACO: LHLD SEAJ      ;KEY(J) <- [DATA: (7*SEAJ+LOW)]
0102 CDC200           CALL  MULT7
0105 224C01           SHLD  SEA7J
0108 11F94F           LXI   D,LOW-7
010B 19               DAD   D
010C 221401           SHLD  SKEYJ
010F CD5501           CALL  CLCHR     ;COMPARE INPUT REFERENCE ADDRESS
0112 4E01             DW    CMPBF     ;  IN <CMPBF> WITH ADDRESS
0114 0000       SKEYJ: DW   0         ;  REFERENCED BY KEY(J)
0116 05               DB    5
0117 CA3401           JZ    SEAOK     ;    IF = THEN CALCULATE ADDRESS
011A D22601           JNC   SLESS     ;    IF < THEN SEAR <- SEAJ
011D 2A4A01           LHLD  SEAJ      ;    IF > THEN SEAL <- SEAJ
0120 224601           SHLD  SEAL
0123 C3DF00           JMP   SEALP
0126 2A4A01     SLESS: LHLD SEAJ
0129 224801           SHLD  SEAR
012C C3DF00           JMP   SEALP
012F 210000     SEXIT: LXI  H,0       ;[HL] <- 0
0132 AF               XRA   A         ;CLEAR [CY]
0133 C9               RET             ;EXIT
0134 21F94F     SEAOK: LXI  H,LOW-7   ;CALCULATE OUTPUT ADDRESS
0137 110500           LXI   D,5
013A 19               DAD   D         ;ADDR <- [LOW+(SEAJ*7)+5]
013B EB               XCHG
013C 2A4C01           LHLD  SEA7J
013F 19               DAD   D
0140 5E               MOV   E,M       ;FETCH ADDRESS OF FILE ENTRY
0141 23               INX   H
0142 56               MOV   D,M
0143 EB               XCHG            ;[HL] <- PHYSICAL ADDRESS
0144 37               STC             ;SET [CY]
0145 C9               RET             ;EXIT; SEARCH SUCCESSFUL
                ;
0146 0000       SEAL: DW    0
0148 0000       SEAR: DW    0
014A 0000       SEAJ: DW    0
014C 0000       SEA7J: DW   0
014E            CMPBF: DS   5
5000            LOW   EQU   5000H     ;ADDRESS OF INTERMEDIATE TABLE
8000            FILE  EQU   8000H     ;ADDRESS OF MAIN DATA FILE
                ;
                ;
                ;MVCHR (STRING MOVE), CLCHR (STRING COMPARE), AND
                ;SWCHR (STRING SWAP) ARE PARTS OF THE BARC UTILITY
                ;PACKAGE BY CHARLES HOWERTON.  THE FOLLOWING THREE
                ;DUMMY STATEMENTS SHOULD BE REMOVED WHEN THE TABLE
                ;SOFTWARE AND THE UTILITIES ARE ASSEMBLED TOGETHER.
                ;
0153 0000       MVCHR: DW   0
0155 0000       CLCHR: DW   0
0157 0000       SWCHR: DW   0
                ;
0000                  END
```

CIRCLE INQUIRY NO. 25

THE REFERENCE BOOKS

IMPORTANT: $4.95 of your book purchase may be applied toward any of the seminars (see "FEES" for details).

MICROPROCESSORS
FROM CHIPS TO SYSTEMS
Rodnay Zaks
420pp, 150 illustr, ref C201 **$9.95**

Our Bestseller. This book is the result of the author's experience in teaching microprocessors to more than 2000 persons. It presents a comprehensive introduction to all the aspects of microprocessors, from the components to the assembly of a system. The difficulty of each chapter is graduated from the basic concepts to the actual technical details. It is read by students, technicians, managers, engineers, educators, doctors and by all those who wish to understand rapidly and efficiently all the important aspects of microprocessor use, selection, or application.

CONTENTS: *Fundamental Concepts... Internal Operation of a Microprocessor... System Components... Comparative Microprocessor Evaluation... System Interconnect... Microprocessor Applications... Interfacing Techniques... Microprocessor Programming... System Development... The Future...*

MICROPROCESSOR INTERFACING TECHNIQUES
Austin Lesea, Rodnay Zaks
350pp, 320 illustr, ref C207 **$9.95**

FROM KEYBOARD TO FLOPPY DISK: All the basic concepts and techniques for assembling a complete microcomputer system are presented in detail, with over 320 illustrations or diagrams, including teletype, keyboard, floppy disk, CRT display, analog / digital interfacing. One chapter is dedicated to the bus standards, including S100, and IEEE488, and one chapter to testing and debugging.

CONTENTS: *Introduction... Assembling the Central Processing Unit... Basic Input-Output... Interfacing the Peripherals... Analog Conversion... Bus Standards... Case-study: a 32-channel Multiplexer... Digital Trouble-Shooting... Conclusion-Evolution.*

THE LECTURERS

All five seminars will be presented by Austin Lesea and Rodnay Zaks, the authors of the reference books and nation-wide best sellers. Both have taught microprocessor seminars to over 4000 persons, world-wide, and have based their books on their teaching experience. These seminars have consistently received the highest ratings of excellence for their efficiency and educational value. Dr. Rodnay Zaks holds a Ph.D. in Computer Science from U.C. Berkeley, and has been involved with industrial uses of microprocessors since 1972. Austin Lesea holds an M.S. from U.C. Berkeley and has been responsible for the development of the microprocessor laboratory at the university.

SYBEX

SYBEX is specialized in high-level education and training, and provides seminars in the microprocessor field worldwide. Over 4000 persons have graduated from SYBEX microprocessor seminars in the U.S.A., Europe, Japan, and other countries. SYBEX books have been directly derived from this extensive experience in education. Many are accompanied by self-study courses on cassettes, or even vidèotapes. Special courses and video-cassettes can also be prepared.

TO REGISTER

1 - BY PHONE

Call 415/848-8233, you may charge your VISA/MASTERCHARGE by phone.

2 - BY MAIL

Cut and mail registration coupon below. Enclose your payment.
You will receive a prompt confirmation, with the practical details.
You may order books at the same time to enjoy the lower rate.

SYBEX
2020 Milvia St.
Berkeley, CA 94704
Tel: 415/848-8233

SEMINAR REGISTRATION COUPON

Charge my ☐ Visa ☐ Master Charge
Interbank nbr. . . . . Account nbr. . . . .
Expires on. . . . . Signature. . . . .

TOTAL FEE ENCLOSED:

1- Seminars. . . . .
2- Books. . . . .
3- Shipping (optional). . . . .
4- Sales tax on books (California only). . . . .

TOTAL. . . . .

IME

MAIL TO:

SYBEX

Special - Seminars
2020 Milvia St.
Berkeley, CA 94704

CIRCLE INQUIRY NO. 25

Micro Market

FREE NORTH STAR!!!
UTILITY DOCUMENTATION

- Add variable length string arrays to BASIC
- Helpful file handling routines
- Keyboard shorthand routines.

SEND $1 FOR POSTAGE AND HANDLING

MIDWEST DIGITAL
863 Wood Avenue Wichita, KS 67212

ATTENTION NORTH STAR USERS

ARIAN: 8080 Operating System Monitor, Assembler, Editor, Debugger Save & Load Object/Source Files to Disc Resident and Custom Commands <><>$50.00<><>

INVESTMENT PACKAGE: Stocks, Bonds, etc. <><>$25.00<><>

FAMILY PACK: Programs for home and family <><>$25.00<><>

GAMES: Includes "Starfleet" Plus many others <><>$15.00<><>

SUPERSOFT
P.O. Box 1628, Champaign, IL 61820

SHORTY CASSETTES

3M C-10 Low Noise High Denisty. Short enough to rewind and still hold many programs.
$1.50 ea. — 10 for $14.00 — Send $1.00 for complete supply catalog with refund coupon.

eA ELLIAM ASSOCIATES
24000 BESSEMER
WOODLAND HILLS, CA. 91367

TRS-80 COMPUTING

non-profit newsletter
$10 (U.S.)/12 issues payable

Computer Information Exch., Inc.
Box 158
San Luis Rey, CA 92068

D.C. METRO AREA
TYSONS CORNER, VIRGINIA
COMPUTER SYSTEMS STORE
Microcomputers & Peripherals
for Home, School, & Small Business
1984 Chain Bridge Rd., McLean, VA. 22101
703-821-8333

---

isam For MICROPOLIS

- MAGSAM allows you to Create, Retrieve, and Update data records by user defined keys
- Interactive Tutorial Program, File Dump Utility, and User Guide are also included
- Comprehensive User Guide includes generalized ISAM concepts ($5 ordered separately)
- Only $75 for complete MAGSAM package (Distributed on Mod II diskette)

MICRO APPLICATIONS GROUP
7300 CALDUS AVE, VAN NUYS, CA 91406

2708 & 2716 E-PROM PROGRAMMER WITH SOFTWARE

For KIM-1, Motorola 6800, Fairchild F-8, RCA 1802, or Intel 8080.
Assembled & tested, **$59.95.** Kit **$49.95**

Optimal Technology, Inc.
Blue Wood 127, Earlysville, VA 22936
After 1:00 P.M. (804) 973-5482

NOISY TELETYPE!

Reduce the sound level of your TELETYPE Model 33 by installing the Silencer DB-33 Kit. Only takes a few minutes and you need no special tools.

☐ KSR — $14.95 ☐ ASR — $15.95

Calif. res. add 6% sales tax

DATASET, Dept. 3A
P.O. Box 312, Tujunga, CA 91042

IT'S ABOUT TIME!

Finally, a COMPLETE disk utility package for the NORTH STAR MICRO DISK SYSTEM. A MUST for both BUSINESS and hobby systems. PKGUT1 on diskette includes the following

PACKIT — Packs & Unpacks disk files so you can get more storage per disk! CHANGIT — Prints, Dumps and/or Changes data in disk files up to a global level. SORTIT — A generalized sorting utility. COMPIT — File comparison utility. Will compare disk files sequentially or by key and display differences. Diskette with full user's documentation $80.00

North Star BASIC games: ROADRACE, EVENWINS, BIORHYTHM, 3D TICTAC, and the addicting SUPER-WUMP! PKGN1 (5 games on diskette) $15.00

VDM-GAMES (requires SOLOS or CUTER): Real time ROBOTS and ASTEROID! PKGV1 (2 games on 1200 baud CUTS tape) $20.00

Micro Logistics
P.O. Box 922, Madison Square Station, New York, NY 10010
N.Y. res. add applicable sales tax

6800 SOFTWARE

REAL TIME CLOCK — Software + instructions for adding a REAL TIME CLOCK to your computer. For under $3. in additional parts, this interrupt will give your SWTPC 8K BASIC, or machine language programs the time of day $7.50
GRAPH #1 — Create real-time graphics with ease from your machine language program — also generates ASCII characters! Uses the SWTPC GT-61 display $5.50

Each program requires a 6800 with MIKBUG, or compatible monitor. Memory required: under 2K. Full source listing and MIKBUG paper tape are included, or add $1.00 for Kansas City format cassette to each price above.

*We also have GAMES, UTILITY PROGRAMS, and a FORTRAN CROSS ASSEMBLER. Write for flyer!
*Coming soon, an enhanced Graphics package with ASCII, Russian, and Greek characters plus other features. Please write for details.

APPLIED MICROCOMPUTER SYSTEMS
Box 68, Silver Lake, NH 03875

Turn-Key Micro-Computer Systems for professional, commercial and industrial applications. Demonstrations and consultation by appointment. Featuring IMSAI, Applied Data Communication, CP/M and Micro-Soft BASIC.

COMPUTER EMPORIUM
17931 "J" Sky Park Circle, Irvine, CA 92714
(714) 540-8445

Check our prices — We will not be undersold!

POLY-8813	1 drive-No monitor	$2500
POLY-88	System 2	$575
IMSAI I-8080	22 Slot	$575
IMSAI	PC Boards/Kits	15% Off
NORTH STAR	NDS-A Kits	$585
EXTENSYS	Memory	20% Off

AAAA Computer How's
1477 Barrington, Suite 17
W. Los Angeles, CA 90025 (213) 477-8478

ENIGMAS-1 $8 ENIGMAS-2 $8
*** Books of Computer Games in BASIC ***

ENIGMAS-1 Gone Fishing, Concentration, Starship, Craps, Slot Machine, Sherlock Holmes, Tank Attack.
ENIGMAS-2 Number Guess, Mortar Battle, In-Between, Shell Game, Safari, Starship-2, Dice Roll, Puzzle.
*****Catalog and test program Frog Race $.50*****
Available in Standard BASIC, SWTPC 8K BASIC or RADIO SHACK'S TRS-80 BASIC. Please specify.

B. Erickson
P.O. Box 11099 Chicago, IL 60611

C10+ CASSETTES

DESIGNED FOR MICROCOMPUTERS

Price includes cassette, hard box, 2 extra labels and shipping. 30 day warranty. Calif. customers add sales tax. Send check or bankcard no., expiration date and signature. VISA and M/C accepted.
Sample $1, 10-Pack $7.50, 50-Pack $32.50.
Dealer inquiries invited.

MICROSETTE COMPANY
777 Palomar Avenue, Sunnyvale, CA 94086

AN S-100 BUS COMPATIBLE COMPUTER FOR UNDER $150?

Single board, S-100 compatible 8080-based computer designed at the University of Iowa to use the Intel cosmetic reject kit.

Features are:

- Memory: four 1702 EPROM's or three 1702's and two 2111's
- Power-on jump and independently selectable board address
- Uses TMS5501 multi-function I/O controller:
  - Parallel in, parallel out
  - USART
  - Five interval timers
  - Handles vectored interrupts
- TTY or RS232 interface on board
- Fully S-100 compatible
- Socket for front panel connection (IMSAI front panel connector pin compatible)

Ideal CPU replacement for IMSAI's and Altairs.
Will run with just applied unregulated voltages as a single board computer.
Bare board, schematics, limited documentation $35
Schematics, limited documentation (includes simple monitor for single board operation) $3

Handling Fee $1.00
uPMEM
1291 Center St. N.E.
Cedar Rapids, Iowa 52402

TIS

Documentation and software applications packages for the COMMODORE PET 2001. Workbooks from $3.95; software from $4.95.

For a flyer describing all our products, please send a self-addressed stamped envelope to TIS, P.O. Box 921. Los Alamos, NM 87544.

FIFO FLEA MARKET

PROM PROGRAMMING: From Binary or Intel paper tape: 1702A ($4), 2708 ($8). From Hex or Octal listing: 1702A ($5), 2708 ($16). You supply the PROM. Quantity discounts on multiple copies. 48-hour turnaround. David Corbin, 11704 Ibsen Dr., Rockville, MD 20852, (301) 881-7571 after 6 P.M.

FOR SALE: TRS-80 Level I or II data base manager $20. Inventory $20. Stock and bank account $15. Lunar, gunner, slot, crap $13. Poi Pow, 96 Dothan St., Arlington, MA 02174.

APPLE II SOFTWARE: Available to swap. Send a list of your programs and SASE for my list (over 100 programs). Most in color graphics. Ed Avelar, 2850 Jennifer Dr., Castro Valley, CA 94546, (415) 538-2431 any day 6-11 p.m.

MOTOROLA D2 USERS: A new manual of experiments on 6800 microcomputers containing 83 interesting assembly language problems. Step by step approach to learn to use the 6800 instructions, digital input/output, interrupts and many programming techniques. $5.00. Send check to K. K. Rao, Department of Physics, Western Michigan University, Kalamazoo, MI 49008.

TRS-80 ASSEMBLER USERS: Z-80 disassembler available. Displays the contents of your memory as symbolic instructions and ASCII code, where relevant. Zilog mnemonics used throughout. Also shows memory addresses and contents in hexadecimal. Requires Level I BASIC with 16K and assembler, or Level II BASIC. (Specify which you have). Execution tape and instructions, $20. For information send SASE to Hubert Howe, 14 Lexington Rd., New City, NY 10956.

WILL TRADE my collection of old radio shows (comedy, drama, mystery, sci-fi, etc) for microcomputer hardware. 1000 shows — about 500 hours of fun for a working 8K 8080A or Z-80 system. More shows available for periphs and other stuff. Shows recorded on ¼-inch tape, ¼ track mono at 3¾ i.p.s. Sam Grossman, 322 N. Harper Ave., Los Angeles, CA 90048 or call (213) 653-3577.

FREE PET COMPUTER PROGRAMS: Will trade original versions of Space War or Graphic Gomoku (9x9 tic-tac-toe) for your software creations of comparable size. Send programs on cassette for exchange, or send SASE for current list of programs. Please indicate serial number of PET used. Bennett Meyer, Box 575, White plains, NY 10602.

ADVERTISER INDEX

*Manufacturer requests factory-direct inquiry.

NEW PET, TRS-80, POLY SOFTWARE: Bomber, Biorhythm, Lander on tape $9.50. Fits in 4K, has dynamic graphics. Send SASE for complete catalog. Ted Carter, 902 Pinecrest, Richardson, TX 75080, (214) 235-0915.

FOR SALE: Heath H8, H9, 16K memory, assembled, up and running, tape recorder, all documentation. $1200. David Marcus, 430 Wolf Hill Rd., Dix Hills, NY 11746, (516) 427-1926.

FOR SALE: Apple II software-cassette: Author-Title Index program for books, records, tapes, super-fast machine language sort, 16K Blackjack, graphic, paddle input, sound, full L.V. rules; autoplay by computer, $10 each including documentation. Both for $15. George W. Lee, 18803 S. Christina Ave., Cerritos, CA 90701.

FOR SALE: TDL ZPU Z-80 processor, new with dual clocks at 2MHz and variable to 4 MHz, S-100, factory built. $175. ITEL Selectric based office word processing system. Will trade for working Selectric I/O. C. David Reinhart, Box 212, Louisville, IL 62858, (618) 665-3030.

TRS-80 Programming Contest, win $500. Send SASE to TRS-80, P.C.-I., P.O. Box 621, Fenton, MO 63026.

FOR SALE: TEI MCS-112 factory assembled. S-100 mainframe & PS ($400); Cromemco ZPU & 4KZ RAM; Artec 16K RAM; FACIT 4070 paper tape punch ($350); Remex punch and reader ($200); Morrow Wunderbus, assembled ($50); ACT 1 video term w/Motorola 12" video monitor, keyboard, power supply, fan, in Enclosure Dynamic cabinet ($400). Gary Gaugler, 2276 Beaver Valley Rd., Fairborn, OH 45324, (513) 878-0288.

COMPUTER T-SHIRTS, Quality white T-shirts with 8080, 6800 or 9900 Pin-out in color on the front. S, M, L, XL. Specify size. Blue and red available. Specify preference. $4.50 each, includes shipping. Pat Stakem, P.O. Box 745, College Park, MD 20740.

FOR SALE: COSMAC VIP, $275 Video Processor, National SC/MP Kit (assembled) $99.00, SWTP keyboard-5 $45.00, JVC 3040 TV with RF modulator $107.00, Panasonic RQ-309DS cassette recorder $35.00. Will sell to best offer for everything. Write to P.F. Dolin, Bldg. 866, Apt. 3-J, Govs. Is., NY 10004.

FOR SALE: TRS-80 software. Lowest cost. For complete free catalog, please write to Kun Lee, 72 Nottinghill Rd., Brighton, MA 02135.

TRS-80 Software. Four full-length simulations for 4K Level I. Includes Pioneer, Survival, Capitalists, and Space Voyage. All 4 for $10. Also, Baseball, Football, Hockey, Lander, all with graphics, 7 in all for $8, or get all 11 for $15. For programs, an updated list, or freelance programming, write Michael Flanagan, 130 Holly, Riveredge, OH 44135.

TRS-80 Programs available. Send SASE for list of well documented software. Also have BASIC coding forms designed for 32, 40 or 64 character input. First 40 sheets $2.25, each additional 50 $2.25. John De Mita, 53 Fenimore St., Lynbrook, NY 11563.

FOR SALE: SWTP 6800 assembled, 8K, parallel interface all assembled. Also AC-30, CT-64 and PR-40 in kit form in original boxes. Will accept any reasonable offer. Will take care of all export problems for U.S. bidder. John Atwood, 5 Lloyd Pl., St. Albert, Alberta, Canada T8N 2H4.

WANTED: SWTP GT-61 and RCA VIP and ELF II with cassette interface. Joe, 51625 Chestnut Rd., Granger, IN 46530.

KLIENSCHMIT ASCII Print Drum (76 col), Electronics/parts for 311-321 printer. Best offer takes it. Bill Vaughn, 2415 Richview Cr., Garland, TX 75042, (214) 495-2371 evenings.

WANTED: Scrolling mod for Southwest Technical Products' CT-1024 video terminal. Will trade 64 char/line mod or expanded cursor control board mod for up to 26 control functions, or whatever? R. Schubert, 7016 No. Rosemead, Apt. 28, San Gabriel, CA 91775.

WANTED: Used Motorola Exorciser. Any leads anyone could give me in finding this unit would be appreciated. Lynn C. Kurtz, 2104 Campo Alegre Rd., Tempe, AZ 85281, (602) 946-9986.

FOR SALE: Kleinschmidt teletype model TT-117/FG with reperforator/transmitter, Baudot code, used working $100. Tektronix type CA dual trace plug in unit $150. M.H. Research plus & minus 300 volt DC power supply model R100B $25. Locarte 3 Amp 120 volt DC power supply (not isolated from AC line) $20. All items plus shipping. S. Lei, P.O. Box 5312, Fargo, ND 58102.

TRS-80 Users: Business programs for all levels. Describe your application and I will give you an estimated cost within 48 hours. Also, 4K, Level 1 Star Trek. 6 Commands: Warp engines, short range scan, long range scan, phasers, photons, and Galactic records. Very complete and running. Very challenging; gives rating at end of game. Full documentation $10.00. Plus, Psychiatrist program which runs in 4K $7.00. Write for catalog of Level 1 and 2, 4K and 16K programs. Send SASE to Sandy Sigal, 6851 Mammoth Ave., Van Nuys, CA 91405.

FOR SALE: Low power 4K static memory. Full speed. Tested and reliable. $75. G. Mitchell, P.O. Box 35, Chula Vista, CA 92012.

FOR SALE: 1 Creed Model 75 TTY with carriage return and repeat option, paper tape winder, 4 boxes paper tape, Creed manual. In working condition. $150 plus shipping. Stambaugh, 5009 Guide Meridian, Bellingham, WA 98225.

READER SERVICE CARD 1

INTERFACE AGE™

September 1978 Issue
Void after Dec. 31, 1978
(Please type or print)

Name____________________ Title__________

Company ________________ Phone (A/C) __________

Address ____________________ ☐Home ☐Business

City _____________ State____ Country____ Zip______

ANSWER THE FOLLOWING BY CHECKING ONLY ONE BOX PER QUESTION.

1. I Am A:
A. ☐Professional (Medical, Accounting, Law, Etc.)
B. ☐Engineer (Electronics, Mechanical, Etc.)
C. ☐Business Person (Retail, Wholesale, Etc.)
D. ☐Educator (Professor, Teacher, Assistant, Etc.)
E. ☐Student
F. ☐Hobbyist
G. ☐Other________

2. My status is:
A. ☐Have all computing equipment
B. ☐Need more peripherals
C. ☐Have CPU only
D. ☐Have no equipment
E. ☐Other________

3. I need this information for:
A. ☐Immediate purchase
B. ☐Purchase 30-60 days
C. ☐Comparisons
D. ☐Literature Library
E. ☐Other________

4. My interest emphasis is:
A. ☐Hardware
B. ☐Firmware
C. ☐Software
D. ☐Other________

5. My application is:
A. ☐Hobby only
B. ☐Business only
C. ☐Hobby & Business only
D. ☐Instruction Purposes
E. ☐Research
F. ☐Design & Development
G. ☐Other________

6. My primary source of "State-of-the-Art" information comes from:
A. ☐Magazines
B. ☐Exhibits & Conventions
C. ☐Club meetings
D. ☐Direct mail from manufacturers
E. ☐Other________

7. I prefer to buy:
A. ☐Directly from manufacturers
B. ☐Local computer retailer (store)
C. ☐Mail order
D. ☐Club group purchase
E. ☐Other________

8. I look to INTERFACE AGE first for:
A. ☐New product information
B. ☐Software information
C. ☐Tutorials
D. ☐Hardware articles
E. ☐Product advertising
F. ☐Remarks________

Please send information on items circled below:

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25
26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50
51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75
76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100
101 102 103 104 105 106 107 108 109 110 111 112 113 114 115 116 117 118 119 120 121 122 123 124 125
126 127 128 129 130 131 132 133 134 135 136 137 138 139 140 141 142 143 144 145 146 147 148 149 150
151 152 153 154 155 156 157 158 159 160 161 162 163 164 165 166 167 168 169 170 171 172 173 174 175
176 177 178 179 180 181 182 183 184 185 186 187 188 189 190 191 192 193 194 195 196 197 198 199 200
201 202 203 204 205 206 207 208 209 210 211 212 213 214 215 216 217 218 219 220 221 222 223 224 225
226 227 228 229 230 231 232 233 234 235 236 237 238 239 240 241 242 243 244 245 246 247 248 249 250
251 252 253 254 255 256 257 258 259 260 261 262 263 264 265 266 267 268 269 270 271 272 273 274 275
276 277 278 279 280 281 282 283 284 285 286 287 288 289 290 291 292 293 294 295 296 297 298 299 300
301 302 303 304 305 306 307 308 309 310 311 312 313 314 315 316 317 318 319 320 321 322 323 324 325
326 327 328 329 330 331 332 333 334 335 336 337 338 339 340 341 342 343 344 345 346 347 348 349 350
351 352 353 354 355 356 357 358 359 360 361 362 363 364 365 366 367 368 369 370 371 372 373 374 375
376 377 378 379 380 381 382 383 384 385 386 387 388 389 390 391 392 393 394 395 396 397 398 399 400

READER SERVICE CARD 2

INTERFACE AGE™

September 1978 Issue
Void after Dec. 31, 1978
(Please type or print)

Name____________________ Title__________

Company ________________ Phone (A/C) __________

Address ____________________ ☐Home ☐Business

City _____________ State____ Country____ Zip______

ANSWER THE FOLLOWING BY CHECKING ONLY ONE BOX PER QUESTION.

1. I Am A:
A. ☐Professional (Medical, Accounting, Law, Etc.)
B. ☐Engineer (Electronics, Mechanical, Etc.)
C. ☐Business Person (Retail, Wholesale, Etc.)
D. ☐Educator (Professor, Teacher, Assistant, Etc.)
E. ☐Student
F. ☐Hobbyist
G. ☐Other________

2. My status is:
A. ☐Have all computing equipment
B. ☐Need more peripherals
C. ☐Have CPU only
D. ☐Have no equipment
E. ☐Other________

3. I need this information for:
A. ☐Immediate purchase
B. ☐Purchase 30-60 days
C. ☐Comparisons
D. ☐Literature Library
E. ☐Other________

4. My interest emphasis is:
A. ☐Hardware
B. ☐Firmware
C. ☐Software
D. ☐Other________

5. My application is:
A. ☐Hobby only
B. ☐Business only
C. ☐Hobby & Business only
D. ☐Instruction Purposes
E. ☐Research
F. ☐Design & Development
G. ☐Other________

6. My primary source of "State-of-the-Art" information comes from:
A. ☐Magazines
B. ☐Exhibits & Conventions
C. ☐Club meetings
D. ☐Direct mail from manufacturers
E. ☐Other________

7. I prefer to buy:
A. ☐Directly from manufacturers
B. ☐Local computer retailer (store)
C. ☐Mail order
D. ☐Club group purchase
E. ☐Other________

8. I look to INTERFACE AGE first for:
A. ☐New product information
B. ☐Software information
C. ☐Tutorials
D. ☐Hardware articles
E. ☐Product advertising
F. ☐Remarks________

Please send information on items circled below:

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25
26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50
51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75
76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100
101 102 103 104 105 106 107 108 109 110 111 112 113 114 115 116 117 118 119 120 121 122 123 124 125
126 127 128 129 130 131 132 133 134 135 136 137 138 139 140 141 142 143 144 145 146 147 148 149 150
151 152 153 154 155 156 157 158 159 160 161 162 163 164 165 166 167 168 169 170 171 172 173 174 175
176 177 178 179 180 181 182 183 184 185 186 187 188 189 190 191 192 193 194 195 196 197 198 199 200
201 202 203 204 205 206 207 208 209 210 211 212 213 214 215 216 217 218 219 220 221 222 223 224 225
226 227 228 229 230 231 232 233 234 235 236 237 238 239 240 241 242 243 244 245 246 247 248 249 250
251 252 253 254 255 256 257 258 259 260 261 262 263 264 265 266 267 268 269 270 271 272 273 274 275
276 277 278 279 280 281 282 283 284 285 286 287 288 289 290 291 292 293 294 295 296 297 298 299 300
301 302 303 304 305 306 307 308 309 310 311 312 313 314 315 316 317 318 319 320 321 322 323 324 325
326 327 328 329 330 331 332 333 334 335 336 337 338 339 340 341 342 343 344 345 346 347 348 349 350
351 352 353 354 355 356 357 358 359 360 361 362 363 364 365 366 367 368 369 370 371 372 373 374 375
376 377 378 379 380 381 382 383 384 385 386 387 388 389 390 391 392 393 394 395 396 397 398 399 400

First Class
Permit No. 217
Clinton, Iowa

BUSINESS REPLY MAIL

No Postage Stamp Necessary if Mailed in the United States

Postage will be paid by

INTERFACE AGE™ Magazine

Box 2654

Clinton, Iowa 52732

First Class
Permit No. 217
Clinton, Iowa

BUSINESS REPLY MAIL

No Postage Stamp Necessary if Mailed in the United States

Postage will be paid by

INTERFACE AGE™ Magazine

Box 2654

Clinton, Iowa 52732

SDS-100 THE ULTIMATE SMALL BUSINESS COMPUTER

The SDS-100 is pure computing power. . . designed strictly for small business and professional applications. The proven SD Systems computer boards give you reliability, unequaled flexibility and performance through standard software programs. The system is packaged in a totally shielded single case, housing two full-size dual-sided floppy disk drives, a full sized 12" video monitor, the keyboard and the SDS-100 computer power.

For the more technical features: ● 32K Random Access Memory (Expandable to 64K on board) ● 1,025,024 Bytes of on line disk storage ● IBM 3740 Compatible 12-inch Video monitor reading 80 characters by 24 lines ● Numeric accounting and statistical keyboard ● Full cursor control keys ● Parallel and Serial (RS-232) input and output ports ● C/PM Operating System (by Digital Research of Pacific Grove, California).

The SDS-100 is available through your local SD Dealer. The price of the SDS-100 is $5,795.00 FOB Dallas, Texas. For information concerning the location of your nearest dealer call toll free, 800-527-3460 or 800-527-2304.

CIRCLE INQUIRY NO. 44

sds SD Systems

P.O. Box 28810 • Dallas, Texas 75228 • TELEX 73-0151

SD SALES COMPANY

214-271-4667 • 800-527-2304 • 800-527-3460